HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Tulalip Coho
Species or Hatchery Stock:	Skykomish Coho
Agency/Operator:	Tulalip Tribes
Watershed and Region:	WRIA 7 (Snohomish), Puget Sound
Date Submitted:	March 2, 2004
Date Last Updated:	March 2, 2004

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program. Bernie Kai-Kai Gobin Hatchery, Tulalip Coho.

1.2) Species and population (or stock) under propagation, and ESA status.

Coho salmon (*Oncorhynchus kisutch),* Skykomish River coho.

1.3) Responsible organization and individuals

Indicate lead contact and on-site operations staff lead.

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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

Egg takes will be conducted in cooperation with the Washington Department of Fish and Wildlife (WDFW) Wallace River Hatchery or other spawning facilities using broodstock surplus to production needs.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Funding Sources: Bureau of Indian Affairs. The Tulalip Tribes.

Staffing level: Four, full-time Tulalip Tribal employees, and numerous seasonal workers: one eight months, one four months, and from one to twelve temporary workers during spawning, egg shocking and picking, fish transfers, and tagging operations.

Annual hatchery program operational costs: Operational costs are approximately $300,000 annually for the entire Tulalip Hatchery program.

1.5) Location(s) of hatchery and associated facilities.

Tulalip Creek- WRIA 07.0001, RMPC Code - 3F10308 070001 R.
Tulalip Salmon Hatchery- WRIA 07.0001, RMPC Code - 3F10308 070001 H.

Tulalip Tribes' Bernie Kai-Kai Gobin Salmon Hatchery:
10610 Waterworks Road
Tulalip, WA 98271

Located at the juncture of the east and west Forks of Tulalip Creek and just above the point at which Tulalip Creek feeds into Tony's Marsh, river kilometer 2.0.

Upper Tulalip Creek pond:

Near to:
7515 Totem Beach Rd.
Tulalip, WA. 98271

The upper Tulalip Creek pond is located behind a dam just upstream from lower Tulalip Creek pond, which drains directly into Tulalip Bay via a fish ladder, and/or a valved pond draining line. WRIA 7, stream number 0001, stream kilometer 0.1.

Lower Tulalip Creek Pond and Spawning Station:

Near to:
7515 Totem Beach Rd.
Tulalip, WA. 98271

The lower Tulalip Creek pond is located just downstream from the upper Tulalip Creek pond, which feeds it via a screened outlet structure between the upper to lower Tulalip Creek ponds. The lower Tulalip Creek pond is located in WRIA 7, stream number 0001, stream kilometer 0.0.

1.6) Type of program.

Isolated Harvest.

1.7) Purpose (Goal) of program.

The purpose of this program is to provide coho salmon for harvest by Tulalip Tribal members in a terminal area fishery. Production from this program is also available for harvest by the non-Indian sport fishery and contributes to other directed and incidental harvest of coho salmon in other preterminal fisheries.

1.8) Justification for the program.

The Tulalip coho stock is classified as a secondary management unit in all areas, except 8D, where the fishery is managed to target Tulalip coho while minimizing interceptions of other coho stocks. A portion of coho salmon production from the Bernie Kai-Kai Gobin Hatchery will be adipose fin-clipped and coded-wire tagged so that hatchery fish can be identified in preterminal and terminal fisheries and on natural and hatchery spawning grounds. Since the 1999 brood year, approximately one-quarter to one-third of the coho production has been mass-marked with adipose fin clips. This fraction may be increased in the future. The Stillaguamish and Snohomish natural coho stocks are classified as primary management units.

1.9) List of program "Performance Standards".

1. Provide hatchery fish for terminal area harvest in a manner that maintains overall harvest-related impacts to listed populations below guidelines adopted in the Co-managers' Comprehensive Coho Management Plan and below exploitation rate ceilings developed in the U.S. – Canada Pacific Salmon Commission's Southern Coho Management Plan.

2. Provide for terminal area harvest of hatchery-produced coho in a manner that does not jeopardize achievement of the coho salmon management objectives of the Co-managers.

3. Provide for terminal area harvest of hatchery-produced coho in a manner that does not jeopardize achievement of the Chinook salmon management objectives of the Co-managers.

4. Maintain the contribution rate of hatchery-produced fish to natural spawning populations below guidelines adopted by the Co-managers.

Goal (Section 1.7-1.8)	**Performance Standard** (Section 1.9)	**Performance Indicator** (Section 1.10)
Produce coho salmon to meet harvest needs.	Hatchery return will provide opportunity for weekly 3-day Tulalip Tribal fishery openings for coho salmon in Area 8D as well as for a non-Tribal coho-directed sport fishery in the same area.	On average, the estimated survival rate for the hatchery production will remain above 0.04 to 0.06 to provide: • for the recruitment of 40,000 to 60,000 December Age 2 coho, and • an average terminal harvest rate of > 0.95.
	Harvest directed at Tulalip hatchery coho does not unduly impact listed or natural-origin Chinook or coho salmon populations when considered in conjunction with all other harvest-related impacts on those populations.	▪ Annual fisheries plans project exploitation rates below the Co-managers' guidelines for all Puget Sound coho and Chinook salmon management units. ▪ Post-season assessments of exploitation rates on Stillaguamish and Snohomish coho and Chinook salmon remain below the Co-managers' guidelines.
Provide the broodstock needed to maintain the hatchery program.	See the Wallace River Hatchery HGMP.	See the Wallace River Hatchery HGMP.

Limit genetic and ecological impacts to natural populations to acceptable levels.	The hatchery production will not contribute significantly to naturally-spawning coho populations.	The proportion of Tulalip-origin spawners in natural coho spawning areas will remain below Co-managers' guidelines.
	Broodstock collection minimizes risks to natural salmon populations.	See the Wallace River Hatchery HGMP..
	Release practices do not unduly impact natural salmon production.	Evaluate the level of interaction of Tulalip Bay releases with out-migrating natural salmon smolts. Test the hypothesis that the timing of the peak abundance of Tulalip coho salmon and naturally-produced salmon does not differ significantly.
		Using newly-acquired smolt trapping data in lower mainstem portions of the Skykomish, Snoqualmie, and North and South Fork Stillaguamish Rivers, collect relative out-migrant timing and body size data, and apply adaptive management to minimize the risk of predation of released program coho on listed Chinook salmon juveniles.
		Delay releases of program coho until late-May each year to reduce temporal overlap with small juvenile Chinook salmon juveniles (see out-migrant smolt trap timing and size data discussed in Sections 2 and 10.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

Please see the performance standards in Section 1.9 above. Note, annual accomplishment of research, monitoring, and evaluation projects listed throughout this HGMP and in performance standards and indicators is contingent on availability of funding. As of 2004, most hatchery reform and HGMP monitoring projects have been accomplished primarily through acquiring Hatchery Reform and self-governance funds specifically dedicated for hatchery reform and rehabilitation.

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

No coho broodstock will be collected at the Tulalip Hatchery or from natural coho populations. The Bernie Kai-Kai Gobin Hatchery will take 1.3 million green eggs and milt each year from the WDFW Wallace River Hatchery from eggs available as surplus to the on-station program needs of this facility.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Life Stage	Release Location	Annual Release Level
Yearling	Tulalip Bay	1.0 million

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Survival estimates are based on CWT recoveries. Please see http://www.nwifc.wa.gov/CRAS.

1.13) Date program started (years in operation), or is expected to start.

A Memorandum of Agreement between the Tulalip Tribes and WDFW was signed on May 20, 1981, describing the initial salmon enhancement goals for the Tulalip Tribes' Bernie Kai-Kai Gobin Salmon Hatchery, including guidelines for native stock recovery, the relationship of the enhancement program with harvest management strategies, and a framework to establish a periodic review process with subsequent application of appropriate adaptive management.

1.14) Expected duration of program.

Ongoing.

1.15) Watersheds targeted by program.

Tulalip Bay (within WRIA 7). The program is designed so that as close to possible of the entire

adult coho return will be harvested in the terminal Area 8D fishery where no hatchery returns are intended to spawn naturally.

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

N/A.

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

2.1) List all ESA permits or authorizations in hand for the hatchery program.

This HGMP is being developed to provide the basis for an incidental take permit under an ESA Section 4(d) rule.

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.

Chinook salmon populations within the threatened Puget Sound ESU that may be affected by this program include Skykomish Chinook salmon, Snoqualmie Chinook salmon, and North and South Fork Stillaguamish Chinook salmon.

- Identify the ESA-listed population(s) that will be directly affected by the program.

None are known at this time. See the WDFW HGMP for the Wallace River Hatchery for incidental effects of coho broodstock collection on listed Chinook populations (none are expected). Direct effects on the ESA-listed Chinook salmon populations as a result of conducting the actions described in this program might include competition or predation between listed juvenile Chinook salmon and program coho in estuarine and nearshore marine areas upon release of juvenile coho (see Sections 2.2.3 and Attachment 1 below). Since there are no listed fish in Tulalip Creek, and Tribal releases under this program are directly into the marine waters of Tulalip Bay, there are no interactions with listed fish in any freshwater habitats while juvenile coho are hatched and reared at the Tulalip Hatchery, nor during their release from lower Tulalip Creek into Tulalip Bay.

- Identify the ESA-listed population(s) that may be incidentally affected by the program.

See the WDFW HGMP for the Wallace River Hatchery for incidental effects of coho broodstock collection on listed Chinook populations (none are expected). See Sections 2.2.3 and Attachment 1 for potential incidental impacts of program coho releases that might lead to the take of listed Chinook salmon juveniles in the target area as a result of the hatchery release activities described in this HGMP. The local listed Chinook salmon populations are North and South Fork Stillaguamish, Snoqualmie, and Skykomish River Chinook salmon, which have been identified by the Puget Sound TRT as part of the Puget Sound Chinook salmon ESU.

2.2.2) Status of ESA-listed salmonid population(s) affected by the program.

- **Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.**

Currently, the listed Chinook salmon populations from the Stillaguamish and Snohomish basins, listed in 2.2.1 above, are above their critical thresholds. Complete delineation of populations and determination of viable population thresholds has not yet been completed.

- **Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.**

Please see relevant information provided in the Bernie Gobin Tulalip Salmon Hatchery fall Chinook salmon HGMP.

- **Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.**

Please see relevant information provided in the Bernie Gobin Tulalip Salmon Hatchery fall Chinook salmon HGMP.

- **Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.**

This information is currently unknown for coho hatchery programs.

2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take

Hatchery activities that might lead to the take of listed fish in the target area are described in the next section. Monitoring and evaluation activities that might lead to the take of listed fish in the target area are described in Sections 11 and 12 of this HGMP, in the February 1, 2000, Biological Assessment prepared by the Tulalip Tribes, in the February 28, 2000, NOAA Fisheries Biological Opinion (#F/NWR/2000/00242) under ESA Section 7 (16 U.S.C. 1531 et seq.), in the February 4, 2000, Joint aquatic Resources Permit, in the Puget Sound Tribal Chinook Research Plan submitted July 10, 2000 (65 FR 42481), and in the Section 10 Native Endangered Species Interstate Commerce and Recovery Permit submitted by the Tulalip Tribes to the U.S. Fish and Wildlife Service, also on February 4, 2000. Take levels approved for these M&E and research activities have not been exceeded (See Section 11).

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

See the WDFW HGMP for the Wallace River Hatchery for incidental effects of coho broodstock collection on listed Chinook populations (none are expected).

Out-migration studies have been conducted since 2000 in the Stillaguamish River by the Stillaguamish Tribe (Griffith et al. 2001, Griffith et al. 2003, Griffith et al. 2004), since 2000 in the Skykomish River, and since 2001 in the Snoqualmie River by the Tulalip Tribes (Nelson and Kelder 2001, 2002a, 2002b, 2002c, 2003a, 2003b), and additional fyke netting and beach seining has been conducted in the Snohomish River estuary and nearshore marine areas by the Tulalip tribes and NOAA Fisheries since 2001. These studies are providing better information on the relative juvenile out-migrant timing and size of local listed and hatchery populations of Chinook and coho salmon, so that we can assess the extent to which any overlap between these species might occur after hatchery fish are released, and apply adaptive management as needed to limit the potential for adverse hatchery-induced ecological effects of program coho on listed Chinook salmon (see results and adaptive management below).

Although potential direct impacts of released program coho predation or competition on listed Chinook salmon juveniles have not been identified as of this date, based upon findings from the smolt trapping operations described above, estuarine and nearshore residency of listed Puget Sound Chinook salmon juveniles may overlap with that of juvenile coho released by this program. The ecological effects of this overlap in timing between hatchery-origin coho and river-origin listed Chinook salmon juveniles, and the actual degree of interaction resulting from this overlap are unknown at this time.

Relative size and temporal overlap are important factors that may affect predation on natural Chinook fry from program coho. Size and timing release goals stated in earlier versions of the Tulalip Coho HGMP were 137 mm fork length (18 fpp) and a release period goal ranging from May 5 to June 10 annually. Nelson and Kelder (2002b) found that mean fork length of 0+ Chinook fry egressing from the Snoqualmie River increased in size from a mean of 42 mm in late April to a mean of 71 mm by the middle of June in 2001. Increases in body length of 0+ Chinook fry were not observed until the first week in May that year.

To examine natural Chinook fry growth (fork length) patterns during this period, size and out-migrant timing data collected in smolt trapping efforts by the Tulalip and Stillaguamish Tribes in the Skykomish, Snoqualmie, and Stillaguamish Rivers were graphed for 0+ Chinook out-migrants captured from 2001 through 2003 (Attachment 1). Data for the Skykomish and Snoqualmie Rivers was taken from Tulalip preliminary reports (Nelson and Kelder 2001, 2002a, 2002b, 2002c, 2003a, 2003b) and from smolt trapping reports and data provided by the Stillaguamish Tribe for 0+ Chinook out-migrants also captured from 2001 through 2003 (Griffith et al. 2001, Griffith et al. 2003, Griffith et al. 2004), relative to the Tulalip coho smolt size and release timing goals from 2001 through 2003. Smolt trapping data from the Snoqualmie and Skykomish River progress reports are preliminary and should not be cited or used without permission by the Tulalip Tribes.

For all systems, it was observed that the size (fork length) of 0+ Chinook out-migrants increased significantly after approximately the third week in May each year. As noted in a recent ESA 4(d) review of a previous version of the Tulalip Coho HGMP by the NOAA Sustainable Fisheries Division (Tim Tynan personal communication), the risk of potential predation by yearling coho on emigrating juvenile Chinook during the earliest portion of the original coho release period (during the first few weeks of May each year) was of particular concern because the Chinook fry out-migrating at that time from the Snohomish system were found to be relatively small during that period.

Size and timing data for 0+ Chinook out-migrants, relative to the Tulalip coho release size and timing goals, were first analyzed individually for each of the years of smolt trapping from 2001 through 2003 in the Skykomish, Snoqualmie, and Stillaguamish Rivers. Fork lengths were measured from 4,033 0+ Chinook captured before May 21 ("Early") and from 760 captured after May 21 ("Late") in the Skykomish River in 2001-2003, and weighted means were calculated to be 43.0 mm and 57.9 mm, respectively. Fork lengths were measured from 1,287 0+ Chinook captured before May 21 ("Early") and from 512 captured after May 21 ("Late") in the Skykomish River in 2001-2003, and weighted means were calculated to be 43.9 mm and 59.8 mm, respectively.

Since weighted mean fork lengths were found to be within 1-2 mm between 0+ Chinook emigrating from the Skykomish and Snoqualmie Rivers during these early and late periods from 2001 through 2003, the length data was combined from a total of 6,592 0+ Chinook captured from the Skykomish and Snoqualmie traps for all three years and analyzed. The overall weighted mean fork length for "Early" Chinook fry was 43.2 mm and 58.7 mm for "Late" Chinook fry. Grand means, calculated from the inter-annual weighted mean fork lengths were very similar to the overall weighted means, being 43.9 ± 0.8 (Mean ± SEM) for "Early" Chinook fry (range 41.6-45.8) from both systems and 58.5 ± 2.3 for "Late" Chinook fry (range 48.4-65.2) from 2001-2003. Graphs and preliminary reports for Tulalip trapping efforts during these years are included in Attachment 1.

Mean fork lengths were calculated for 0+ Chinook emigrants captured before May 24 ("Early") and after May 24 ("Late") from Stilliguamish River smolt trapping data among 15-17 different sampling periods each year from 2001-2003. While 0+ Chinook were found to be, on average, larger than Chinook fry emigrating from the Snohomish system during the same time periods, they also were observed to experience a significant increase in size later in May each year, increasing from a mean of 50.4 ± 0.9 mm to a mean fork length of 69.1 ± 0.3 mm after May 24 for the 2001-2003 out-migration years. Graphs for Stillaguamish trapping efforts during these years are included in Attachment 1.

Since the out-migration timing of natural Chinook 0+ fry does temporally overlap with the previous release timing goal for Tulalip program coho, their juvenile estuarine and nearshore residency may also overlap. Although this overlap, and any subsequent ecological interactions, have not yet been identified in estuarine or marine waters, the Tulalip Enhancement Program has decided to reduce the release target size for yearling coho smolts from 137 mm to 123 mm based on past success in modulating coho growth rates prior to release, and we are also modifying our release timing goal by moving it forward from the initial May 5 start date to after May 22 each

year, when possible, to minimize the potential for negative ecological interactions between program coho and listed Chinook salmon juveniles. Based on the weighted mean fork lengths shown above, releasing program coho after the third week in May annually (mean fork length 43.9 mm for Snohomish 0+ Chinook and 50.4 mm for Stillaguamish Chinook before May 21, 58.5 mm and 60.1 mm after May 21), could afford natural 0+ Chinook fry an average increase in fork length of approximately 15 to 19 mm in all three river systems mentioned above, before program coho are released. This also corresponds with the findings described in Nelson and Kelder (2002b), who found that mean fork length of 0+ Chinook fry egressing from the Snoqualmie River increased in size from a mean of 42 mm in late April to a mean of 71 mm by the middle of June in 2001.

It is also very important to remember that the 0+ Chinook out-migrant size data presented above is not representative of the overall Chinook out-migrant size in the Snohomish River, *because it is only for subyearling fry, and excludes yearling smolts, which are much larger*. Length data for Chinook sub-yearlings was segregated from Chinook yearlings using descriptive statistics from length frequency histograms to determine a threshold value to separate the two year classes (Nelson and Kelder 2001, 2002a, 2002b, 2002c, 2003a, 2003b). Because of increases in size over time, the histograms were constructed from fork length data for several different time periods. Juvenile Chinook that had fork lengths greater than or equal to the time period's threshold value were considered to be yearlings, and were excluded from the analyses shown above. Although the length data discussed above is subsequently skewed toward smaller size for natural Chinook, we believe that this is a conservative estimate, which addresses the concern of program coho predation on the smallest, most vulnerable size class of the natural-origin juvenile Chinook out-migrants.

This new release timing goal is contingent on there being adequate flows and resultant dissolved oxygen and water quality conditions to sustain coho production until this later release date. On future release years when coho densities are high and flow rates, dissolved oxygen, and water quality are low, the Tulalip Enhancement program will reserve the right here to release program coho before pond conditions deteriorate to the point where fish health and survival are compromised. The release timing goal is therefore to release yearling coho after the third week in May annually, whenever possible, without compromising fish health and survival; and on years when fish have to be released before the third week in May, the goal will still be to release the coho as late as possible, again without compromising fish health or survival.

- **Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken and observed injury or mortality levels for listed fish**.

See the WDFW HGMP for the Wallace River Hatchery for incidental effects of broodstock collection on listed populations.

- **Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).**

See the WDFW HGMP for the Wallace River Hatchery for incidental effects of broodstock

collection on listed populations.

The extent of possible adverse competitive and predation effects of juvenile hatchery coho upon their release on listed populations of Puget Sound Chinook salmon has not been quantified at this time but is thought to be low and is under investigation. Preliminary data from smolt trapping monitoring studies was presented above in the latter part of Section 2.2.3, and in Attachment 1. Based on these findings, adaptive management actions were already implemented resulting in changes in release time and size at release, which we believe will alleviate the potential for adverse effects on 0+ natural-origin juvenile Chinook salmon.

Additional data are being collected by Tulalip Fisheries and NOAA in the estuarine and nearshore marine areas, which may provide additional insight as to whether or not Tulalip coho are present in these areas, and the timing of any occurrences. Logistics and sources of funding to conduct additional sampling of program yearling coho stomach contents to look for evidence of predation are being pursued, which may also include the need to otolith mark the Tulalip coho production to increase the statistical likelihood of recovering program fish among large numbers of other coho out-migrants (some estimates have suggested as many as two million coho smolts may pass through the Snohomish estuary alone).

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

See the WDFW HGMP for the Wallace River Hatchery for incidental effects of broodstock collection on listed populations and contingency plans. Adaptive management will be applied to change or modify hatchery practices to eliminate or reduce take, if direct or incidental impacts are found to occur from program to listed natural fish whenever practical and feasible.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

Not applicable.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

The Puget Sound Salmon Management Plan (PSSMP 1985) sets out the legal framework under which co-management of hatchery programs occurs. Programs at the Bernie Kai-Kai Gobin Hatchery are included in the Stillagaumish/Snohomish Equilibrium Brood Document, which is currently in draft form only. Annual production levels are agreed to by the Co-managers and are described in the Future Brood Planning Document. Hatchery escapement goals and terminal

area harvest management plans are described in the annual Stillaguamish/Snohomish regional status report, produced approximately in early-July each year, entitled, "Puget Sound Salmon Forecasts and Management Recommendations, Stilliguamish-Snohomish Region". The basic agreements between WDFW and the Tulalip Tribes concerning the operation of the Bernie Kai-Kai Gobin Hatchery were set up in a memorandum of understanding agreement dated May 29, 1981.

A Memorandum of Understanding Agreement (June 1, 2003) between WDFW and the Tulalip Tribes, effective through June 1, 2005, describes numbers of coho that will be marked, tagged or not marked or tagged for brood years returning through 2005, and conditions for doing so. The Tulalip Tribes and WDFW agreed to the State mass-marking (by removal of the adipose fin) only those 45,000 brood year 2002 and 2003 yearling coho salmon from Wallace River Hatchery that are also coded-wire tagged as part of the double-index tagging program. It was agreed that no other brood year 2002 or 2003 yearling coho salmon released at Wallace River Hatchery will be marked by removal of the adipose fin.

The Tulalip Tribes agreed to mark at least 250,000 brood year 2002 and 2003 yearling coho salmon from the Bernie Kai-Kai Gobin Hatchery by removal of their adipose fins, with the intention of mass-marking as many coho as possible given physical, logistical and funding constraints of this facility. A total of 300,000 coho were marked at Tulalip in 2003 from brood year 2002. These numbers include 50,000 fish that were/will also be coded-wire tagged and adipose fin-clipped each year. The Tribes agreed to hire all personnel necessary to conduct the marking, and WDFW agreed to be responsible for reasonable increased costs for activities necessary to mass-mark the adipose- clipped-only fish.

3.3) Relationship to harvest objectives.

The *Comprehensive Coho Management Plan* sets out harvest management objectives (exploitation rate ceilings) for each Puget Sound coho natural (key wild) production management unit. Exploitation rate ceilings are also set forth in the U.S. – Canada Pacific Salmon Commission's Southern Coho Management Plan. Harvest of Tulalip coho is conducted in terminal Area 8D where hatchery fish have separated from other stocks as they return to their point of release in Tulalip Bay. The Tulalip Tribes utilize time and area management and pulse fisheries to focus harvest on hatchery fish. These methods are being evaluated through sampling of the terminal area fishery for coded-wire tags.

The Co-managers are also following a harvest management plan for Puget Sound Chinook salmon. The National Marine Fisheries Service initially issued biological opinions for salmon fisheries within Puget Sound conducted between May 1, 2000, and April 30, 2003, concluding that these fisheries did not create jeopardy to listed Puget Sound Chinook salmon. Currently, the Co-managers recently submitted a plan for fisheries to be conducted between May 1, 2004, and April 30, 2009, for consideration by NOAAF. This *Co-managers' Puget Sound Chinook Harvest Management Plan* (February 21, 2003) lists harvest management objectives for each Puget Sound Chinook management unit. All operations of the Bernie Kai-Kai Gobin Hatchery are consistent with the above plans.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Coho fisheries are directed at Tulalip coho in terminal Area 8D during the time that adult hatchery fish return to Tulalip Bay (approximately mid-September through mid-November each year). The Tulalip Tribes open a net fishery for Tribal members three days per week. The WDFW opens a recreational hook and line fishery, also three days per week, through September, annually. After that time, recreational fisheries targeting hatchery coho are operated concurrently with recreational fisheries targeting mixed hatchery/wild populations. Catch in the net fishery is recorded on fish tickets, and catch in the sport fishery is estimated by angler interviews and aerial surveys conducted by the WDFW. This program also contributes to other directed and incidental Treaty/non-Treaty harvest of coho salmon in fisheries in British Columbia, the Washington coast, and Puget Sound preterminal areas. Estimates of Tribal Area 8D harvest for the past fifteen years are as follows:

Year	Area 8D Tribal Net Catch
1988	33,979
1989	50,690
1990	44,213
1991	43,444
1992	66,909
1993	30,796
1994	79,175
1995	41,470
1996	29,981
1997	23,682
1998	17,159
1999	15,115
2000	73,071
2001	67,281
2002	53,089
2003	6,997

Harvest rates on Tulalip coho are managed to be as close to 100% as possible. This is possible because adults return to Tulalip Bay where they are targeted by the fishery and not allowed to pass upstream into Tulalip Creek. Actual terminal area harvest rates on Tulalip coho were 84% in 1997 and 95% in 1998 (from State/Tribal RRTERM database), with nearly all of the harvest taken in hatchery Area 8D. Future management of Tulalip coho will continue to focus on harvesting as close as possible to 100% of the hatchery return while minimizing the impact of fisheries directed at hatchery-produced coho on listed populations or other salmon populations of concern.

Beginning with brood year 1999, at least 250,000 of the Tulalip coho release have been mass-

marked with adipose fin clips (300,000 were mass-marked beginning in broodyear 2002). These marked fish will be available for selective harvest in recreational fisheries with appropriate regulations.

Exploitation rates on listed populations of Chinook salmon as well as natural coho populations are evaluated by the Co-managers based on total exploitation in all fisheries as assessed using the Fishery Regulation Assessment Model (FRAM). The Co-managers are currently operating under a Comprehensive Coho Management Plan governing all harvest of Puget Sound-origin coho salmon. The contribution of incidental harvest of listed populations in the Area 8D fishery to overall exploitation rates is estimated with the FRAM model, which has been calibrated for Chinook salmon impacts, based on recent years' recoveries of coded-wire tags. In future years, we continue to anticipate that overall exploitation rates on key wild coho management units and listed Chinook salmon populations affected by the Area 8D fishery will be less than the Co-managers' guidelines. All impacts to other natural coho or Chinook salmon populations by the Area 8D fishery will continue to be monitored through ongoing collection of coded-wire tag data.

3.4) Relationship to habitat protection and recovery strategies.

This coho enhancement program is an important consideration in ongoing habitat protection and recovery strategies aimed at addressing factors affecting natural salmon production and developing habitat management plans to facilitate salmon recovery. Although these include concentrated efforts focused on ESA-listed Puget Sound Chinook salmon, hatchery fish and other species are also included in recovery plans, in modeling efforts, and in habitat assessment, protection, restoration efforts. Work groups in the Stillaguamish and Snohomish watersheds are currently developing these plans. Initial recommendations for the Snohomish basin are described in the *Initial Snohomish River Basin Chinook Salmon Conservation /Recovery Technical Work Plan (October 6, 1999).*

3.5) Ecological interactions.

Predators, especially Double-Crested cormorants, but also river otters and mergansers, have recently been found to induce significant mortalities on Tulalip coho fingerlings after they are transported to the large earthen reservoir (upper Tulalip Creek pond) for final rearing prior to their release. This pond is located adjacent to marine waters at Tulalip Bay. It is possible that this predation pressure selects for yearling hatchery coho that are more capable of avoiding predators after their release. These predators, and others, such as staghorn sculpin, cutthroat trout, and Dolly Varden trout, have sometimes been observed preying on juvenile salmon released into Tulalip Bay. Predation impacts are currently being assessed through an extensive population monitoring program from ponding through release.

After enumerating the 2003 coho smolt release from the upper Tulalip Creek pond with an electronic fish counter, it is now possible that some marine survival rates for past brood years of Tulalip coho were possibly even higher than previously estimated, if findings observed in the 2003 release, that there were quite a few less fish being released than estimated, were true in certain other years when the releases were not enumerated. Exposure to predators and other natural rearing conditions, coupled with minimal human contact, was/is attributed to their post-

release success, but local populations of cormorants and otters, thought to be the primary predators, have increased significantly in recent years, and are now believed to be causing unacceptable levels of mortality prior to release in the upper pond.

After observing large numbers of double-crested cormorants and river otters in the upper Tulalip Creek pond (plus other bird predators such as mergansers, terns, gulls, kingfishers, and cutthroat and rainbow trout predator fish) prior to the 2002 coho release, the fish would not surface to accept feed prior to their release. Fisheries staff speculated that nearly all of the fish had either been predated upon and were gone, or they were stressed out and were hiding near to the bottom. Coho catch in the Tulalip Tribal terminal area fishery in Tulalip Bay in 2003 (returns from that 2002 release) amounted to the worst coho fishing season ever recorded for Tulalip, suggesting that most of the fish were in fact consumed by predators. Preliminary 2003 catch records indicate that the Tribal coho catch in Tulalip Bay was only about 15% of the recent three-year average (mean coho catch in Tulalip Bay from 2000-2002 is 65,000 average).

In 2003, the following year, an electronic fish counter, was used to determine that more than 50% of the coho fingerlings that were ponded in October of 2002 in the upper pond were lost by the time the smolts were released in June of 2003, which amounted to an overall loss of 73% from green egg to release. This has created great concern among Tribal fishermen who heavily depend on the coho fishery, as well as causing trepidation for Tribal Fisheries Directors and technical staff. Extensive cormorant predation was observed, and numerous river otters were observed in near proximity to this pond, but bird predation was primarily attributed to the loss of more than half of all of the coho salmon released in 2003, and funding to implement immediate measures to curb this loss is being sought through Hatchery Reform. In addition, the fish counter was irreparably broken, and funding is also being sought to purchase a new fish counter, which is more accurate and which will allow for quality assurance and control to verify the accuracy of the electronic counter.

Rather than simply trying to kill or fence out all of the predators, only to have them continually replacing themselves or constantly having the hatchery crew attempt to keep all of the predators out of this pond, our strategy to address this problem evolved by first addressing the true problem, which is that this hatchery program has created a food source, opportunistic predators are simply taking advantage of it, and some lower level of predation was not detrimental to production and was quite likely beneficial to post-release survival. We will pursue funding to apply new Hatchery Reform natural rearing methods (by actually continuing to enhance the natural rearing characteristics that are already present in this pond), but at the same time controlling and limiting the amount of predation to acceptable levels. This will be accomplished by designing netted and fenced safe zones and predation training areas within the pond, which will afford the fish opportunities to experience a limited level of predation while increasing pre- and post-release survival.

Hatchery fish can interact with listed fish species through competition and predation (Fresh 1997). Program fish can negatively impact listed fish populations causing reduced growth, survival, and abundance. Several methods have been developed to assess potential negative ecological interactions and risks associated with hatchery programs (Pearsons and Hopley 1999; Ham and Pearsons 2001). The degree to which fish interact depends upon fish life-history characteristics which include: 1) size and morphology, 2) behavior, 3) habitat use, and

4) fish movements (Flagg et al. 2000). Important considerations associated with hatchery practices include the type of species reared, timing of release relative to occurrences of natural fish, fish size at time of release, number of fish released, and location(s) of program releases.

The potential for interactions among hatchery- and natural-origin fish can certainly depend on habitat structure and system productivity. For example, habitat structure can influence predator-prey encounter rates (visibility), the amount of preferred spawning habitat, and fish susceptibility to flushing flows. System productivity determines the degree to which fish populations may be food-limited, and thus negatively impacted by density-dependent effects. The type and degree of risk associated with releases of program fish typically involve complex mechanisms. Actual identification and magnitude of causal mechanisms negatively impacting listed fish is not always definitive due to confounding factors such as human-induced environmental changes, indirect pathway effects, and the diversity of environments salmon occupy throughout their life-cycle (Li et al. 1987; Fausch 1988; Fresh 1997; Flagg et al. 2000). Given these complex mechanisms and site-specific considerations, it is not surprising that for most hatchery programs, the extent of possible adverse competition and predation effects of hatchery releases on listed fish populations have not been explicitly documented or quantified throughout most of Puget Sound.

Releases of yearling Tulalip coho salmon may pose a predation risk on juvenile Chinook salmon in the marine environment (Hargreaves and LeBrasseur 1985; Hawkins and Tipping 1999; Pearsons and Fritts 1999). Actual rates of predation by program releases of yearling Tulalip coho salmon on juvenile Chinook salmon are unknown at this time. Because Tulalip coho are released directly into the marine environment, they will not contact juvenile Chinook salmon in freshwater, and likely not in the estuary in Tulalip Bay either. This reduces the overall predation risk by delaying any interactions from this program until program and listed fish or other juvenile salmon have entered the marine environment.

Trapping studies in the Skykomish and Snoqualmie Rivers by the Tulalip Tribes and in the Snohomish River estuary and nearshore marine areas by the Tulalip Tribes and NOAA Fisheries are currently underway, as previously described, which may help to answer some of these considerations about interactions between released hatchery fish and their potential interactions with natural-origin salmonids. Preliminary findings from some of these monitoring efforts were previously described in Section 2.2.3 and in Appendix 3.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Well water, and/or Wallace River and May Creek surface water, supply influent to the Wallace River Hatchery for holding broodstock. After spawning and transporting gametes to the Bernie Kai Kai Gobin Hatchery, well water will be used to incubate the eggs and hatch alevins, unless power or pump failures occur. If well water cannot be pumped, gravity freed lines will be available from the east and west forks of Tulalip Creek. Swim-up fry will be ponded in small, outdoor raceways and will be gradually conditioned onto combined flows of the east and west forks of Tulalip Creek, which also supply influent to larger raceways and asphalt ponds at the

hatchery as well as to the upper and lower Tulalip Creek ponds, until smolts are released into Tulalip Bay.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Water withdrawal and screening do not affect listed natural fish, because none are present in Tulalip Creek. Effluent discharge is highly unlikely to affect listed natural fish, because it passes through a natural biofilter below the hatchery, then into the upper and lower ponds, and then directly into sea water. The effect, if any, to the marine environment, has not been quantified.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Broodstock will be collected at WDFW traps installed seasonally on May Creek and on the Wallace River, and then they will be held in ponds at the Wallace River Hatchery. The Wallace River is located in WRIA 7, stream number 0943. The Wallace River Hatchery is located at river mile 4.0 of the Wallace River, and stream mile 0.0 of May Creek.

Once spawned at the Wallace River Hatchery, unfertilized eggs in pails, and milt in plastic bags under oxygen, will be transported to the Tulalip Tribes' Bernie Kai-Kai Gobin Hatchery, where they will be fertilized and subsequently disinfected in Heath vertical stack incubators with a 100 ppm buffered iodophor solution for one hour (static bath treatment). After the one-hour disinfection, fertilized eggs will be incubated on well water, (or Tulalip Creek water in the case of a power or pump failure). Eggs will be prophylactically treated with a 1,667 ppm (1:600; v:v) formalin drip treatment for 15 minutes, three times per week, to control growth of opportunistic *Saprolegnia* sp. fungus on the eggs until shortly before hatching. When the eggs reach the eyed stage, they will be shocked, mortalities will be removed, and the healthy eyed eggs will be placed back into the incubators with an artificial substrate to control movement and optimize growth and health. Any eyed egg disinfections with iodophor will be in static 100 ppm concentrations but only for 10 minutes. Once fry have hatched and emerged, they will be transferred by hand to small, outdoor raceways and started on salmon starter mash.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

The unfertilized green eggs will be transported by truck from the Wallace River Hatchery to the Tulalip Hatchery in dry, disinfected buckets. The buckets will be covered with insulation to protect them from cold. The milt will be collected in sealable plastic bags that will be filled with oxygen and placed in chillers on racks above ice.

Zero-age coho held in large, concrete hatchery ponds will be transported in October each year to the upper Tulalip Creek rearing pond for final rearing and yearling release the following May or June. They will be transported in a fish transfer truck for only about four miles under oxygen with agitators in each of three 600-gallon tanks.

5.3) Broodstock holding and spawning facilities.

See 5.1 above.

5.4) **Incubation facilities**.

See 5.1 above.

5.5) Rearing facilities.

Swim up fry will be placed on starter mash in the small outdoor raceways. Once fry reach a weight of about 400 fish per pound, they will be transferred via underground lines to a larger concrete rearing pond (Pond A), where they will be held until approximately June each year. As rearing densities increase, they will be split, leaving approximately two thirds in pond A on first-use water, and approximately one third will be transferred by hand to another large concrete rearing pond (Pond B). Pond B is fed by reuse water pumped from pond A, after it passed through re-oxygenation and nitrogen removal towers.

Once the coho have been marked with coded-wire tags in early October, they will be transported to the upper Tulalip Creek rearing pond, where they will be fed and acclimated until their release at a weight of approximately 18 fish per pound in late-May to early-June each year.

5.6) Acclimation/release facilities.

Upper Tulalip Creek pond is a large, earthen pond formed by a dam on Tulalip Creek. This pond has been in existence for about 80 years, and has an estimated working volume of 800,000 ft^3. Yearling coho acclimate to this pond as they would to a natural pond, and learn to feed naturally, avoid predators, use overhead and within-pond cover, in-column structure, natural substrate, and thus take on the natural coloration, body morphology, and behavior that is more characteristic of natural juvenile coho salmon. Recent increases in predation have become severe, which is necessitating changes to the structure (a combination of netting and fencing to curb fish losses to predation) to control levels of bird predation, yet allow reduced levels to occur to preserve natural rearing conditions without suffering excessive predation losses.

When yearling coho reach the smolt stage in late-May to early-June each spring, they will be transferred to the lower Tulalip Creek pond by removing stop logs, outlet screens, and opening valves. By doing this, their movement into the lower pond is semi-volitional and occurs over a protracted time period (up to 3+ weeks). They are then released into Tulalip Bay through a three-foot diameter pipe by opening a valve on an incoming high tide. If possible, releases are conducted just before dark to help the coho avoid predators as they exit the pond into Tulalip Bay as the tide drops.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

None.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

1. Broodstock capture, holding, spawning, egg fertilization, and incubation is supervised by properly-trained hatchery workers, managers, and an enhancement biologist.

2. The stock will be reared in a location (Tulalip Creek) that is devoid of naturally-spawning salmon, and thus any escapees cannot interact with natural-origin salmonids.

3. The incubation system of the Tulalip Hatchery is equipped with low-water alarms and back-up water supplies.

4. Both hatcheries have well-trained staff that are on duty 24 hours per day, seven days a week.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

Coho broodstock will be collected from returns to the WDFW Wallace River Salmon Hatchery and are of native Skykomish River origin.

6.2) Supporting information.

6.2.1) History.

See the WDFW HGMP for the Wallace River Hatchery.

6.2.2) Annual size.

See the WDFW HGMP for the Wallace River Hatchery for more information.

6.2.3) Past and proposed level of natural fish in broodstock.

See the WDFW HGMP for the Wallace River Hatchery.

6.2.4) Genetic or ecological differences.

None known. Broodstock origin is the native stock and the majority of their rearing is in natural

habitat with minimal human interaction.

6.2.5) Reasons for choosing.

This is the locally-adapted stock, native to this region. Using this stock in the Tulalip coho enhancement program reduces the potential for negative genetic and ecological interactions to occur with local natural stocks to the extent that program fish interact with these stocks after they are released, because program fish are the same stock. This stock has survived well for 25 years being reared at Tulalip and released directly into Tulalip Bay. This indicates that this stock is well suited to a lowland, temperate water hatchery and adapts readily to the marine environment.

The stock is local to WRIA 7, and there is a history of cooperative agreements between the Tulalip Tribes and WDFW describing understandings concerning salmon culture programs of the Tulalip Bernie Kai-Kai Gobin Salmon Hatchery, operated by the Tulalip Tribes, and the Wallace River Hatchery, operated by WDFW, which include provisions for WDFW to supply broodstock for the Tribal enhancement program. This stock has not been prone to disease problems, especially any regulated fish pathogens.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

See the WDFW Wallace River Hatchery HGMP for broodstocking protocols. Semi-natural to natural rearing for the majority of their culture experience minimizes domestication effects, as described below in Section 9.2.9, "*Use of natural rearing methods as applied in the program*."

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Green eggs.

7.2) Collection or sampling design.

See the WDFW Wallace River Hatchery HGMP.

7.3) Identity.

Skykomish River coho salmon.

7.4) Proposed number to be collected:

1.3 million unfertilized eggs and associated milt to fertilize these eggs (1:1) after transfer to Tulalip.

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

1,000 adult coho broodstock.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

The WDFW Wallace River Hatchery collects the broodstock, but egg transfer numbers taken to Tulalip for this program are shown below:

Skykomish River fall coho green egg numbers collected and transferred from the Wallace River Hatchery to the Bernie Kai-Kai Gobin Tulalip Tribal Hatchery.

Brood Year	Number of green eggs transferred from the Wallace River Hatchery to Tulalip	Stage
1988	1,400,000	Green
1989	1,400,000	Green
1990	1,400,000	Green
1991	1,400,000	Green
1992	1,400,000	Green
1993	1,500,000	Green
1994	1,300,000	Green
1995	1,600,000	Eyed
1996	1,300,000	Green[1]
1997	1,300,000	Green[2]
1998	1,300,000	Green
1999	1,307,500	Green[3]
2000	1,300,000	Eyed
2001	1,400,000	Green
2002	1,353,000	Green
2003	1,631,354	Green

[1] Also 195,000 Skykomish coho fry were provided to Tulalip, total BY-'96 eggs and fry was 1,495,000.
[2] Also 56,880 Skykomish coho fry were provided to Tulalip, total BY-'97 eggs and fry was 1,356,880.
[3] Also 100,100 Skykomish coho fry were provided to Tulalip, total BY-'99 eggs and fry was 1,407,600.

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

All program coho returns to Tulalip are intended to be harvested in fisheries and are not used for broodstock. Surplus returns to the hatchery rack will either be distributed to Tribal members, donated to food banks, or sold to a contracted buyer.

Surplus coho returning to the Wallace River Hatchery will be handled in various ways. The first consideration is to return excess adult coho to the river when appropriate. Excess fish not returned to the river will either be donated to food banks, sold to a contracted buyer, or the carcasses will be placed back into the streams as a means of nutrient enhancement.

7.6) Fish transportation and holding methods.

See Sections 5.1 and 5.2.

7.7) Describe fish health maintenance and sanitation procedures applied.

See Section 9.2.7 for more details on how fish health monitoring, disease treatment, and sanitation procedures will be conducted at Tulalip. At Wallace, adult broodstock will be sampled for viruses, *Renibacterium salmoninarum*, the causative agent of bacterial kidney disease, and other regulated fish pathogens in accordance with the Salmonid Disease Control Policy of the Fisheries Co-manager's of Washington State (NWIFC and WDFW 1998). Spawning procedures will follow the guidelines set forth in the WDFW Hatchery Division Fish Health Manual.

7.8) Disposition of carcasses.

Spawned and unspawned carcasses that have not been exposed to antibiotics or chemical treatment will typically be sold to a fish buyer; otherwise all carcasses will be buried on station at the Wallace River Hatchery.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Not applicable. No listed fish are believed to be affected by the coho broodstock collection program. Summer Chinook are not present when adult coho are collected in November each year.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

Please see the WDFW HGMP for the Wallace River Hatchery for additional information.

8.1) Selection method.

Adult coho will be selected randomly over the entire run.

8.2) Males.

No back up males or repeat spawners will be used. Jacks will be spawned at a rate of 2% over the spawning season.

8.3) Fertilization.

Equal sex ratios will be used and gametes will be pooled in lots of 5.

8.4) Cryopreserved gametes.

Not applicable.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

No listed natural fish will be used. The native coho stock will continue to be the source of broodstock, and a 1:1 overall ratio mating scheme will be employed.

SECTION 9. INCUBATION AND REARING

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Of 1.3 million unfertilized green coho salmon eggs transferred to the Tulalip Hatchery for incubation, approximately 1,000,000 may typically survive to eye up (~76% survival to eye up), and an estimated 900,000 may survive to emergence (~70% survival to ponding).

Increased monitoring efforts are in place to more precisely determine the green-to-eyed egg and green egg-to-hatching survival at the Tulalip Bernie Kai Kai Gobin Hatchery.

9.1.2) Cause for, and disposition of surplus egg takes.

See the Wallace River Hatchery HGMP. No eggs surplus to Tulalip program needs will be transferred to Tulalip Hatchery.

9.1.3) Loading densities applied during incubation.

The loading density will be approximately 6,000 eggs per Heath incubator tray.

9.1.4) Incubation conditions.

Coho eggs will be incubated on approximately 8°C (~47 °F) well water, except during very rare occasions when there might be an extended power outage. In that case, east fork Tulalip Creek water will be used. Both water sources will be at or near oxygen saturation upon entry to Heath stacks and the effluent will be above 90% saturation when it leaves the Heath stacks.

9.1.5) Ponding.

Coho fry will be ponded when they are at or near to full yolk absorption. Dates of ponding will vary according to spawning time at the Wallace River Hatchery. The usual date for ponding coho fry into small outdoor raceways is early- to mid-February each year.

9.1.6) Fish health maintenance and monitoring.

Eyed eggs will be prophylactically treated in the Heath incubators with a 1,667 ppm formalin drip treatment for 15 minutes, three times per week, to control growth of opportunistic *Saprolegnia* sp. fungus. Vexar matting will be positioned in Heath incubator trays to provide substrate for alevins to hold in during yolk absorption, which conserves their energy, improves their health, growth and subsequently their size at emergence, and reduces abrasion of yolk sacs. All dead eggs will be removed after shocking at eye up at the Gobin Hatchery. No further dead egg removal will be done from this stage to ponding.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

Although no listed fish are involved in this program, native stock culture reduces the risk of introducing and amplifying unwanted genetic traits from non-local coho populations. Backup water supplies and alarm systems reduce the possibility for hatchery disasters.

9.2) <u>Rearing</u>:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

The green egg to smolt survival rate is expected to be approximately 65 percent. Little or no precise data exist and new monitoring and inventory methods are being developed and conducted to more precisely measure survival rates prior to release.

9.2.2) Density and loading criteria (goals and actual levels).

Rearing densities will be held under one half pound of juvenile coho per cubic foot of rearing area.

9.2.3) Fish rearing conditions

Before coho fry reach one-half pound of fish per cubic foot of rearing space in the small outdoor raceways, they will be transferred into a larger concrete pond. Fry will be transferred from the

small raceways in early-May each year at a size of approximately 300 fish per pound. Fingerlings will be reared in larger hatchery ponds until approximately October each year, when a portion of these fish will be coded-wire tagged at a size of approximately 30 to 70 fish per pound. The founding coho stock for this program is an indicator stock and is double-index tagged at the Wallace River Hatchery.

A Memorandum of Understanding Agreement (June 1, 2003) between WDFW and the Tulalip Tribes, effective through June 1, 2005, describes numbers of coho that will be marked, tagged or not marked or tagged for brood years returning through 2005, and conditions for doing so. The Tulalip Tribes and WDFW agreed to the State mass-marking (by removal of the adipose fin) only those 45,000 brood year 2002 and 2003 yearling coho salmon from Wallace River Hatchery that are also coded-wire tagged as part of the double-index tagging program. It was agreed that no other brood year 2002 or 2003 yearling coho salmon released at Wallace River Hatchery will be marked by removal of the adipose fin. The Tulalip Tribes agreed to mark at least 250,000 brood year 2002 and 2003 yearling coho salmon from the Bernie Kai-Kai Gobin Hatchery by removal of their adipose fins, with the intention of mass-marking as many coho as possible given physical, logistical and funding constraints of this facility. A total of 306,827 coho fingerlings were adipose fin-clipped from brood year 2002, of which 252,318 were also coded-wire tagged. Adipose-clipped fingerling numbers include approximately 50,000 fish that were/will also be coded-wire tagged each year. This stock is used as an indicator tag group under the Pacific Salmon Treaty. In the previously mentioned MOU agreement, the Tribes agreed to hire all personnel necessary to conduct the marking, and WDFW agreed to be responsible for reasonable increased costs for activities necessary to mass-mark the adipose- clipped-only fish.

After tagging and marking, fingerling coho will be transferred to the upper Tulalip Creek pond where they will be held to a yearling release size of approximately 18 fish per pond, and then released into Tulalip Bay at the mouth of Tulalip Creek.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

This information exists is currently being electronically compiled from historic files. However, for the 2003 coho pre-smolt release, coho were sample weighed and their fork length measured just prior to their late-May release. Mean length was 123.9 mm, mean weight was 19 fpp or 23.5 grams per fish, and mean condition factor was 1.23 (weight in grams/fork length in cm^3).

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

This information exists is currently being electronically compiled from historic files.

9.2.5) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Feed Type / Size	**Fish Size Fish Per Pound (fpp)**
BioVita (BioOregon) / Size 0 mash	2700 – 530 fpp
BioVita (BioOregon) / Size 1 crumble	530 – 300 fpp
Nutra Plus (Scredding) / Size 2 crumble	300 – 197 fpp
Nutra Fry (Scredding) / 1.2-1.5 mm pellet	197 – 80 fpp
Nutra Fry (Scredding) / 1.5-2.0 mm pellet	80 – 18 fpp

Feed conversion rates are not readily available and are being consolidated from historic files.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

Green eggs will be treated with a 100 ppm iodiphor treatment for one hour at the time they are placed into the incubators. Eyed eggs will be treated with the same concentration (100 ppm) of iodophor, but for only 10 minutes (all iodophor treatments are static bath treatments inside Heath trays). Incubating eggs will also be prophylactically treated in the Heath incubators with a 1,667 ppm formalin drip treatment for 15 minutes, three times per week, to control growth of opportunistic *Saprolegnia* sp. fungus.

Each year, Northwest Indian Fisheries Commission (NWIFC) fish pathologists will screen a representative number of adults returning to Tribal hatcheries for pathogens that may be transmitted to the progeny. The exact number of fish to be tested from each stock is specified in the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State. The NWIFC pathologists will work with hatchery crews to help prevent or minimize pre-spawning mortality of brood fish to maximize egg fertilization and survival.

Preventative care will also be promoted through routine juvenile fish health monitoring. Pathologists will conduct fish health exams at each of the Tribal hatcheries on a monthly basis from emergence until release each year. Monthly monitoring exams will include an evaluation of rearing conditions as well as sampling small numbers of juveniles to assess their health status and to detect infectious pathogens of concern. Diagnoses will be reported to Hatchery Managers and the Enhancement Biologist, along with any recommendations for improving or maintaining fish health, and preventing or controlling disease. Vaccines, produced by NWIFC, will be administered as necessary to prevent the onset of two bacterial diseases at this hatchery (vibriosis or enteric redmouth disease), but have not been found to be necessary to date. In the event of disease epizootics or elevated mortality in a stock, a NWIFC regional fish pathologist will be available to diagnose problems and provide treatment recommendations. Pathologists will work with the Enhancement Biologist, Hatchery Manager, and Hatchery Technicians to ensure that drugs and chemicals are dispensed properly during treatments. The entire health history for each hatchery stock will be maintained in a relational database called AquaDoc.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

Not available.

9.2.8) Indicate the use of "natural" rearing methods as applied in the program.

All coho fingerlings will be transferred to Upper Tulalip Creek Pond, a 800,000 ft^3 natural earthen reservoir on Tulalip Creek just above Tulalip Bay. They will be held in this pond for approximately seven to eight months each year (from October to December to late-May to early-June annually). The characteristics of this pond closely mimic natural rearing conditions, including riparian, overhead, and within-pond cover, earthen substrate, natural feed supplementation, in-column structure, natural inflow, natural camouflage coloration/pond color, good water quality and very low rearing densities and presence of natural predators. Program fish develop natural morphology and behavior, including more natural body coloration, predator avoidance, and natural feeding behaviors. By adapting to these natural environmental conditions, the influence of the artificial culture environment will be minimized and is thought to increase their post-release survival leading to high marine survival rates. Also, see Section 5.6, above.

Recent juvenile coho predation losses due mainly to bird predation in the Upper Tulalip Creek Pond have become severe, necessitating changes to the pond structure to control levels of bird predation, yet allow reduced levels to occur to preserve natural rearing conditions without suffering excessive predation losses. We are pursuing Hatchery Reform funding to continue to enhance the natural rearing environment in this pond while controlling predation by designing netted and fenced safe zones and predation training areas within the pond, which will afford the fish opportunities to experience a limited level of predation with the intention of increasing their pre- and post-release survival.

9.2.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

Use of native broodstock, proper mating strategies, and natural rearing of juvenile coho will help to minimize the potential for adverse genetic and ecological effects that may result from the artificial rearing environment.

<u>SECTION 10. RELEASE</u> Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Yearling	1.0 million	18 fish/lb.	May 22 to June 12	Tulalip Bay

Release Practices:

The previous release timing and size goals were May 5-25 @ 18 fpp/137 mm fork length. Given the likelihood of timing and size overlaps conducive to predation between program coho and listed juvenile Chinook salmon (Attachment 1), the release timing for program coho yearlings into Tulalip Bay from this program has been delayed, effective with the 2003 release, to after May 21 each spring through approximately mid-June each year, and the size at release goal was also reduced from a target of 137 mm fork length to a target of 123 mm, as previously discussed in Section 2.2.3, given adequate flow is available to extend holding without jeopardizing fish health at Tulalip. This will reduce the risk for potential predation of yearling program coho that may temporally overlap with the presence of ESA-listed, juvenile, 0-age Chinook in the Snohomish River estuary or in nearshore marine areas, including in Tulalip Bay.

Release methods and monitoring have also been revised extensively at Tulalip. While physical release methods have not changed much over the years, the methods used to estimate the numbers of coho yearling smolts released have varied over the years. Most release estimates for the unmarked and untagged portions of the releases were based on applying an "*assumed survival rate*" to the initial hatchery green egg inventory estimate, which was based on assumed fecundity of Wallace River coho followed by volumetric egg stocking at Tulalip. For portions of the release that were either mass-marked or coded-wire tagged, hard numbers were determined at the time of fingerling tagging in October, and subsequent *assumed survival rates* were applied to these counts after the fish were ponded in the final rearing and release pond. Coho releases from this program contribute significantly to ocean fisheries, and accurate release numbers are critical in order to evaluate survival and overall effectiveness of the enhancement program and to maintain this as an indicator tag group under the Pacific Salmon Treaty.

In recent years, coho losses primarily attributable to cormorant predation, but also to river otter and other bird and fish predation after fingerlings were ponded in large earthen release ponds immediately above Tulalip Bay, have not been possible to accurately quantify and are thought to be very substantial (estimated to be > 50% mortality). Consequently, electronic enumeration and intensive sampling methods during the release have been recently developed.

In future years, and beginning with the 2003 release (broodyear 2001), coho smolts released from the upper Tulalip Creek pond will be enumerated as they pass into the lower Tulalip pond with an electronic fish counter (funding procurement limited) and sampled for CWT and adipose clip status subsequent to their release into Tulalip Bay. In 2003, this was accomplished with a Model FC-3 electronic fish multi-counter (Northwest Marine Technology, Inc., Shaw Island, WA), which consists of a multi-tunnel conductivity bridge housing internal circuitry and 16 conductivity tunnels. However, this counter was subsequently damaged beyond repair, so we are seeking Hatchery Reform funds to acquire a new electronic counter.

The smolts will be enumerated as they pass through the counting tunnels, which will be mounted annually on stop logs and screened panels in a fishway located between the upper and lower Tulalip Creek ponds where coho smolts will be forced to pass through as they move down into the lower pond before being released into Tulalip Bay.

After mounting the counter, a calibration sequence will be conducted to compare manual and

electronic counts. Prior to release, small grab samples of coho smolts in the upper pond will be seined up in several samples, weighed, their fork lengths will be measured, and descriptive statistics of their size and condition factor will be calculated. Upon release, dam boards at the outlet of the upper pond will be removed and the coho smolts will be allowed to emigrate down through the channel and electronic counter. After being enumerated as they pass into the lower Tulalip pond, the smolts will be sampled for coded-wire tag (CWT) and adipose fin clip status, and subsequently released into Tulalip Bay.

At least twice daily throughout the release, hatchery personnel will record the date, clock and counter times, total or individual counts, battery charge readings, and miscellaneous notes including weather and activities such as when dam boards were removed, fish behavior, etc. Conductivities of individual tunnels will be monitored throughout the release along with quality control, comparing electronic and manual counts.

Periodically when significant numbers of coho smolts have emigrated through the counter into the lower pond (but prior to each release), grab samples will be seined from the lower pond, coho smolts will be lightly anaesthetized in 100 ppm MS-222, wanded for tags, visually inspected for adipose clip status, and returned to the lower pond below the counter. Subsequently, numbers of live and dead adipose -clipped & CWT, adipose -clipped no CWT, unmarked CWT only, unmarked no CWT, and numbers of partial adipose-clipped smolts will be enumerated, associated with the date, time, and running cumulative counts for each sample, and then each group will be released at flood tide.

Cumulative and daily counts will later be tabulated and graphed, passage rate (number of smolts per hour) will be calculated, proportions of the mark/tag groups mentioned above will be statistically compared among sample days, between live and dead fish, and between different mark and/or tag groups, and their proportions applied to the total counts to calculate numbers of each group released.

Tag and adipose-clip proportions and total counts will be used to estimate predation loss and survival rates after tagging. This will be possible because we will have annual hard counts of CWT/adipose and adipose-clipped only (mass-marked) smolts enumerated at the time of tagging and clipping, which will also be compared to improved hatchery inventory counts, less enumerated mortality, before the fingerling coho are ponded in these release ponds. Proportions measured for the four tag/mark groups at release will be compared to the proportions at tagging. Chi square tests will be used to compare the relative proportions among live versus dead and among the different sampling periods that assess numbers of smolts for the four possible mark/tag groups in the release. Confidence intervals will also be calculated for the CWT proportion measured at release.

This was accomplished in the 2003 release of broodyear 2001 coho. Prior to that release on 19 May, 2003, small grab samples of coho smolts in the upper pond were seined up in three samples, weighed, and their fork lengths measured. It was found that they had attained a mean weight of 19.3 fpp (23.5 g/fish), a mean ± SEM fork length of 123.9 mm ± 1.22 mm, and a mean condition factor (length in cm/weight in grams3) of 1.23.

A total of 368,404 coho smolts were enumerated by the counter and released into Tulalip Bay

from 22 May through 13 June in several releases over the 22-day period. This amounted to a total biomass released of 19,390 pounds of coho salmon smolts. The passage rate (number of smolts per hour) peaked bi-modally, with the first peak migration rate occurring two days after release on 24 May, which exceeded 7,000 smolts per hour through the counter. Passage rate peaked one week after the release was initiated on 29 May at 9,425 coho smolts per hour through the counter.

Of 1,182 coho smolts assayed for tag status, 83 (7.0%) were adipose -clipped & CWT, 439 (37.1%) were adipose -clipped no CWT, 3 (0.3%) were unmarked CWT only, and 657 (55.6%) were unmarked no CWT. These estimates were derived from pooled mortality (n = 247) and live (n = 935) samples assayed for their tag/mark status after it was determined that there were no significant differences among relative proportions of live and mortality samples (p = 0.5678; chi square) or among the 14 sample periods (p = 0.7898; chi square) for the different groups. The 95% confidence intervals calculated for the CWT proportion measured at release (the point estimate was 7.0% for the pooled CWT proportion estimate) was [5.9% to 8.9%] or a confidence interval of 3 percentage points, indicating that future sampling to derive these proportions should include sample sizes similar to or preferably greater than the sample size (1,182) in 2003. Partial adipose fin clip status was estimated to be 1.8% at smolt release, up from 1.08% after tagging and clipping at the fingerling stage, resulting in an estimated total of 6,545 partially-clipped coho smolts released.

To indirectly get at green egg to tagged fingerling, and fingerling to smolt mortality levels, we back-extrapolated the total number of fingerlings untagged and the grand total number of coho fingerlings after tagging (all groups before ponding). Deriving these numbers prior to ponding allowed for calculation of survival rates to tagging as well as from ponding to release. Since relative proportions of CWT'ed and mass-marked samples were very similar, the total number of fish tagged was extrapolated by adding the actual numbers CWT'ed and mass-marked fingerlings that were tagged (56,221 + 250,692 = 306,913) and dividing that sum by the summed proportion of CWT'ed and mass-marked smolts enumerated during the release [(83 + 439)/1,182 or 44.2%]. This calculation resulted in a total estimated number of fingerlings after tagging, comprising all of the groups, of 694,964 fingerlings.

Since we already had hard counts of numbers of CWT'ed and mass-marked fingerlings at tagging (56,221 + 250,692, respectively), and already had an estimate of the number of CWT only fish by applying a tag loss rate measured after tagging to the number CWT'ed (0.33% tag loss X 56,221 CWT = 186), we were able to calculate the number of unmarked fingerlings at tagging as well, by taking the total estimated number of fingerlings after tagging (694,964) and calculating the difference after subtracting the number CWT hard-counted (56,221), the number mass-marked hard-counted (250,692), and the number CWT only, calculated from measured tag loss (186). This resulted in an estimated 387,865 unmarked coho fingerlings after tagging.

Based on these calculations and counts, we estimate that the green egg to tagged fingerling mortality was 49.6%, and the fingerling to smolt mortality was roughly an additional 53.0% of the fingerling production or 73.7% cumulative (Table 3).

Life Stage	Ad/ & CWT	Ad/ No CWT	Unmarked CWT Only	Unmarked No CWT	Total Count	Est. Cum. % Mortality
Green eggs	N/A	N/A	N/A	N/A	1,400,000	N/A
Fingerlings at Time of Marking	56,221	250,692	186	387,865	694,964	49.6%
Smolts (Released)	25,869	136,827	935	204,773	368,404	73.7%
Fingerling to Smolt Mortality (%)	54.0%	45.4%	N/A	47.0%	53.0%	N/A

Unfortunately, the electronic fish counter, which was already partially damaged, was irreparably broken in 2003 and will have to be replaced. We will be seeking funding, through Hatchery Reform or possibly BIA hatchery cyclical maintenance monies, to purchase a new electronic counter for 2004 and beyond. Due to the high predation measured, we are currently pursuing funding to install netting and fencing to control bird and river otter predation at the release pond site. This is being done in accordance with natural rearing methods where a limited/controlled level of predation will be allowed in the structural design of the netted and fenced areas, allowing predators and fish limited interaction in "predation training zones."

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse: Tulalip Creek and Tulalip Bay.
Release point: Tulalip Creek upper and lower ponds.
Major watershed: WRIA 7 (Snohomish)
Basin or Region: Puget Sound

10.3) Actual numbers and sizes of fish released by age class through the program.

Date(s) of Release	Number Released	Size at Release	Type of Release
5/22/03 to -6/13/03	368,404	19.3	Semi-volitional
5/16/02 to -5/28/02	275,000	18	Semi-volitional
5/15/01	900,000	18	Forced
5/22/00	849,000	18	Forced
5/31/99	1,015,000	18	Forced
5/27/98	620,000	18	Forced
5/19/97	316,618	15	Forced
5/20/96	935,000	17	Forced
5/22/95	1,000,000	16	Forced

See: Section 10.7 below for more release data for Tulalip and WDFW coho releases and see: http://www.nwifc.wa.gov/CRAS for more detailed data on these releases.

10.4) Actual dates of release and description of release protocols.

See above. Based on adaptive management from smolt out migration monitoring studies, the release date for program coho has been delayed, effective with the 2003 release, to reduce the potential risk of predation on juvenile Chinook

10.5) Fish transportation procedures, if applicable.

Not applicable. All releases will be on-station.

10.6) Acclimation procedures.

After enumerating the coho during their semi-volitional emigration from the upper to lower pond, a valve at the outlet of the lower Tulalip Creek pond into Tulalip Bay will be opened during incoming higher high tide. This will allow for several hours of mixing of marine and fresh water prior to when the coho smolts will egress from the lower Tulalip Creek pond to Tulalip Bay at lower low tide.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

A target release goal of 50,000 coho smolts (approximately five percent of the release) is slated to be coded-wire tagged and marked with adipose fin clips at the Tulalip Hatchery. Beginning with the 1999 brood year (2001 release) through brood year 2001 (2003 release), an additional 200,000 smolts (approximately 20% of the release) were mass-marked with adipose fin clips only (a total of approximately 250,000 were clipped each year through the 2003 release, and approximately 300,000 effective with the 2004 release). A new Memorandum of Understanding Agreement (June 1, 2003) between WDFW and the Tulalip Tribes reaffirmed coho smolt numbers that will be released from the Tulalip Hatchery of 50,000 coded-wire tagged and adipose-clipped, and *a minimum* of an additional 200,000 adipose-clipped only (250,000 total clipped minimum release into Tulalip Bay), effective through June 1, 2005. These are minimum clipping goals. For the 2002 brood, we ended up clipping 306,827, of which 54,509 received CWT's.

In addition, WDFW agreed to limit mass-marking of Skykomish River coho released from the Wallace River Hatchery to increase adult returns needed to sustain the broodstock for the Tulalip and Wallace programs. The WDFW will mass mark 45,000 coho that will also receive CWT's for brood years 2002 and 2003 (releases in 2004 and 2005), and an additional 45,000 yearling coho will be coded-wire tagged but not adipose-clipped as part of their double index tagging program. The Tulalip Tribes will conduct the marking at the Bernie Kai Kai Gobin Hatchery

and WDFW will fund the mass-marking of the adipose-only clipped coho as well as the increased costs associated with monitoring the returns, including increased CWT sampling, equipment needed for sampling, and any additional personnel needed.

Marked and unmarked coho smolt numbers released from the Tulalip enhancement program; 1974 to 2003.

Brood Year	Release Year	Ad + CWT	CWT Only	Ad Only	Unmarked	Totals	% Clipped	% CWT
1972	1974	20,685	0	0	262,347	283,032	7.3%	7.3%
1973	1975	60,532	0	498	772,345	833,375	7.3%	7.3%
1974	1976	0	0	0	899,016	899,016	0.0%	0.0%
1975	1977	0	0	0	999,000	999,000	0.0%	0.0%
1976	1978	0	0	0	476,278	476,278	0.0%	0.0%
1977	1979	0	0	0	884,300	884,300	0.0%	0.0%
1978	1980	31,914	0	290	428,071	460,275	7.0%	6.9%
1979	1981	29,562	0	634	596,951	627,147	4.8%	4.7%
1980	1982	18,413	0	1,493	114,113	134,019	14.9%	13.7%
1982	1984	124,439	0	8,084	605,974	738,497	17.9%	16.9%
1983	1985	61,349	0	1,637	424,517	487,503	12.9%	12.6%
1984	1986	185,704	0	1,537	550,568	737,809	25.4%	25.2%
1985	1987	108,592	0	1,291	648,239	758,122	14.5%	14.3%
1986	1988	97,516	0	6,282	724,292	828,090	12.5%	11.8%
1987	1989	104,941	0	3,990	533,488	642,419	17.0%	16.3%
1988	1990	47,870	0	3,383	1,184,330	1,235,583	4.1%	3.9%
1989	1991	50,063	0	1,336	748,601	800,000	6.4%	6.3%
1990	1992	49,183	0	1,313	944,504	995,000	5.1%	4.9%
1991	1993	48,583	0	1,931	891,484	941,998	5.4%	5.2%
1992	1994	49,761	0	676	874,563	925,000	5.5%	5.4%
1993	1995	50,797	0	1,311	947,892	1,000,000	5.2%	5.1%
1994	1996	43,282	0	2,812	888,906	935,000	4.9%	4.6%
1995	1997	28,359	0	837	287,472	316,668	9.2%	9.0%
1996	1998	31,456	0	171,352	588,192	791,000	25.6%	4.0%
1997	1999	0	45,135	0	969,865	1,015,000	0.0%	4.4%
1998	2000	0	41,741	0	807,259	849,000	0.0%	4.9%
1999	2001	47,067	403	243,591	608,939	900,000	32.3%	5.3%
2000	2002	17,729	414	152,445	104,412	275,000	61.9%	6.6%
2001	2003	25,869	935	136,827	204,773	368,404	44.2%	7.3%
				Averages for all years:		**728,846**	**12.1%**	**7.4%**
				Release Year 2001 to 2003 averages:		**514,468**	**46.1%**	**6.4%**
				Release Year 1974 to 2000 averages:		**753,582**	**8.2%**	**7.5%**

The actual percentage of adipose-marked Tulalip coho smolts at release has increased from 8.2% to 46.1% since adipose marking of non-CWT coho began in brood year 1999. This recent year average exceeded the marking rate goal of 25% primarily due to unforeseen fish and egg losses and inventory overestimates prior to tagging (the target numbers were still tagged but

comprised a greater percentage of the total, because the total was reduced). Numbers released that are less than 50,000 for tagged and clipped coho or less than 200,000 for clipped-only coho in recent years were attributed to severe bird predation mortality between the times of tagging and release, which is being corrected. For example, the actual number of yearling coho salmon that were tagged and adipose fin-clipped at the Tulalip Hatchery from brood year 2000 (52,291, not shown above) was considerably higher than the number released (17,729, shown above). Heavy mortality was attributed to bird and otter predation while juvenile coho were reared in the upper Tulalip Creek pond after their transfer in 2001 through their release in 2002. Due to the same predation losses, the actual number of untagged yearling coho that were mass-marked in the Tulalip Hatchery (282,099 fish, not shown above) was far more than the 152,445 that were released as shown above. Addressing this predation problem has been elevated as the highest priority of the enhancement program, and monies through Hatchery Reform and BIA Cyclical Maintenance have been acquired in 2004 to fund installation of anti-predation bird netting and fencing over the yearling coho rearing pond.

While releases into the Wallace River by WDFW, which is a tributary to the Skykomish and subsequently, the Snohomish River, are not directly a part of this program, the returns from those releases supply broodstock for the Tulalip enhancement program, and the Co-managers agreed to reduced marking levels for that hatchery population to improve returns needed to sustain both Tribal and State programs.

The Tulalip Tribes are currently trying to accomplish thermally marking otoliths of 100% of our coho production as well, beginning in the winter of 2004/5 (brood year 2004 coho), if procurement of funding makes this possible. If accomplished successfully, then all Tulalip salmon production will be 100% marked. This will increase the statistical probability of recapturing Tulalip Hatchery-origin juveniles in marine and estuarine areas after their release to study their temporal and spatial overlap and subsequent potential for negative ecological interactions with natural fish.

Stream, river, or watercourse: Wallace/Skykomish River
Release point: Wallace River
Major watershed: WRIA 07.0943 (Snohomish)
Basin or Region: Puget Sound

Marked and unmarked coho smolt numbers released from the WDFW Wallace River Hatchery; 1993 to 2003.

Brood Year	Release Year	Ad + CWT	CWT Only	Ad Only	Unmarked	Totals	% Clipped	% CWT
1991	1993	46,111	0	46	256,843	303,000	15.2%	15.2%
1992	1994	42,462	0	0	289,038	331,500	12.8%	12.8%
1993	1995	44,631	36	0	289,233	333,900	13.4%	13.4%
1994	1996	43,871	73	73	265,483	309,500	14.2%	14.2%
1995	1997	45,933	0	46	263,021	309,000	14.9%	14.9%
1996	1998	46,251	46,094	202,405	5,250	300,000	82.9%	30.8%
1997	1999	45,004	45,091	200,819	11,091	302,005	81.4%	29.8%
1998	2000	43,014	46,977	271,996	11,073	373,060	84.4%	24.1%
1999	2001	47,762	43,430	62,141	2,012	155,345	70.7%	58.7%
2000	2002	39,558	39,344	70,432	0	149,334	73.7%	52.8%
2001	2003	39,467	43,895	80	59,303	142,745	27.7%	58.4%
				Averages for all years:		**273,581**	**44.7%**	**29.6%**
				Release Year 2001 to 2003 averages:		**149,141**	**57.4%**	**56.6%**
				Release Year 1993 to 2000 averages:		**320,246**	**39.9%**	**19.4%**

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Not applicable.

10.9) Fish health certification procedures applied pre-release.

Fish health will be monitored monthly by NWIFC fish pathologists to insure fish are healthy at release.

10.10) Emergency release procedures in response to flooding or water system failure.

During hatchery rearing at Tulalip, it will always be possible to change or supplement the hatchery water source to protect Chinook salmon stocks. In the event of flooding or a water system failure, hatchery personnel have the ability to switch to either well water, west fork, and/or east fork Tulalip Creek water. Flooding is not an issue at the Tulalip Hatchery or in the Tulalip Creek ponds. As described previously in Section 2.2.3, under emergency conditions in years when low rainfall spring weather causes low flows, low DO, and poor water quality that compromises fish health and threatens catastrophic fish losses, coho yearlings may be released earlier than the projected release date to avert fish losses.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

This is an isolated facility. No anadromous fish inhabit Tulalip Creek. Imprinted fish are released directly into marine waters. Coho yearlings are released as smolts and are capable of rapidly migrating to outer marine waters. Since there are no anadromous salmonids in Tulalip Creek and program fish are released directly into marine waters, they have no contact with listed fish in freshwater, and since it is believed that the smolts move rapidly to offshore marine areas, it is probable that their interactions with listed juvenile salmon in the estuarine environment is negligible.

Effective with the 2000 release year, the relative abundances and out-migration timing of natural- and hatchery-origin juveniles has been monitored through cooperative, inter-agency smolt trapping research projects, and beginning in 2002, through fyke netting, and beach seine monitoring projects in the estuary and nearshore marine areas, as previously described. Pocket estuary studies (including at the head of Tulalip Bay) were initiated in 2004 to document hatchery and natural juvenile fish use and temporal/spatial occurrences. Additional studies and data that document interactions among natural-origin and program fish (such as predation or competition) are being planned or are underway and adaptive management strategies will be implemented, whenever possible, to protect ESA-listed fish and minimize any other potential adverse effects on natural fish due to releases of program fish (see Section 11). As previously mentioned, annual accomplishment of research, monitoring, and evaluation projects listed throughout this HGMP is contingent on availability of funding.

Juvenile salmonid trapping studies have been underway for 4 years in the Skykomish and Snoqualmie Rivers, and in estuarine and nearshore marine areas in a cooperative effort between the Tulalip Tribes and NOAA fisheries to study temporal and spatial interactions, relative size and occurrences, and habitat usage of hatchery- and natural-origin salmonids. Preliminary size and timing data from freshwater smolt trapping operations has already been analyzed, in context with previous Tulalip Hatchery coho release time and size goals, to apply adaptive management and modify the time and size at release for Tulalip program coho, as previously discussed in Section 2.2.3. The continuation of these studies will continue to provide valuable information regarding the interaction of program and natural fish to allow for adaptive management to minimize the likelihood for adverse genetic and ecological effects to listed fish in the nearshore marine and estuarine environments resulting from program coho releases. It will be necessary to 100% otolith mark the Tulalip Hatchery coho production (provided adequate funding becomes available) to improve sampling power and the ability to detect juvenile hatchery coho among approximately two million coho juveniles in the Snohomish estuary.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

Note, annual accomplishment of research, monitoring, and evaluation of performance indicators is contingent on availability of funding. As of 2004, most hatchery reform and HGMP monitoring projects have been accomplished primarily through acquiring Hatchery Reform and self-governance funds specifically dedicated for hatchery reform and rehabilitation.

Performance Indicator (Section 1.10)	**Monitoring Plan Objective** (Section 11)	**Methods/Comments** (Section 11)
On average, the estimated post-release survival rate for coho hatchery production from the Tulalip enhancement program will remain above 0.05 to provide: • for the recruitment of 30,000 to 60,000 December Age-3 fish. • an average terminal harvest rate of > 0.95	Overall Wallace River fall coho survival rate estimates are available from reconstructed CWT recoveries for brood years 1986-current (tagging is ongoing).	▪ Coded-wire tag recoveries will be reviewed and analyzed annually to determine adult equivalent survival rates. A model will be developed to relate terminal area returns to overall survival by assuming that preterminal interception rates equal those for nearby indicator stocks. ▪ Stock composition for the terminal area fishery will be determined from weekly sampling of the fishery for coded-wire tags.

Performance Indicator (Section 1.10)	**Monitoring Plan Objective** (Section 11)	**Methods/Comments** (Section 11)
Annual fisheries plans project exploitation rates below the Co-managers' guidelines for all Puget Sound coho and Chinook salmon management units.	FRAM or successor model will be used to make annual projections of impacts	Model inputs for impacts projected for the Area 8D fishery will be updated annually based on results and analysis (see the Tulalip fall Chinook salmon HGMP for further information).
Post-season assessments of incidental exploitation rates on Stillaguamish and Snohomish Chinook salmon, and other Key Wild coho MU's will remain below Co-managers' guidelines.	Post-season analysis of coded-wire tags (from indicators stocks), combined with analysis of otoliths collected from Area 8D (from the Tulalip hatchery Chinook salmon stock) will be conducted.	▪ All fisheries must be sampled for coded wire tags at appropriate rates (at least a 20% sampling rate for net fisheries, and at least a 10% rate for other fisheries). ▪ Otoliths must be collected from at least 100 Chinook salmon per week in the Area 8D fishery for analysis in the laboratory.

Performance Indicator (Section 1.10)	**Monitoring Plan Objective** (Section 11)	**Methods/Comments** (Section 11)
The proportion of Tulalip-origin coho spawners in natural spawning areas will remain below Co-managers' guidelines.	Estimate the annual contribution of Tulalip hatchery coho to natural populations such that the upper bound of the 90% confidence interval is 10% contribution when the true contribution rate is 5%.	▪ This will require a new research project aimed at coho salmon hatchery stray rates. The study could be based on otolith marking of coho, similar to the Tulalip Chinook salmon otolith project currently underway, which will also be required to monitor juvenile program coho interactions with juvenile listed Chinook fry.

Performance Indicator (Section 1.10)	**Monitoring Plan Objective** (Section 11)	**Methods/Comments** (Section 11)
Evaluate the level of interaction of coho releases into Tulalip Bay with other out-migrating natural salmon smolts. Test the hypothesis that the time of the peak abundance of Tulalip coho salmon and naturally-produced salmon in local marine waters do not differ significantly.	Estimate the abundance, temporal and spatial distribution of any natural coho populations that may be present in Tulalip Bay or in the nearby Snohomish estuary and nearshore marine habitats. Estimate the timing of natural Chinook and coho salmon smolt out-migrations from local rivers.	This will require a new research project to establish the optimum time/area strata for release that would minimize impacts on natural juvenile salmon populations in nearshore marine areas. Information from new, in-river smolt trapping in the Stillaguamish and Snohomish systems, and estuarine trapping in the Snohomish will be part of this research. This monitoring will require 100% otolith marking similar to the Tulalip Chinook salmon otolith project currently underway.

Smolt trapping and estuarine surveys of juvenile salmonids and other fish species will provide additional assessment of the status of all natural and hatchery-origin fish residing in the Snohomish basin and estuary.

Smolt out-migration studies are currently underway in the Skykomish, Snoqualmie, and Stillaguamish systems. These smolt trapping activities, along with ongoing studies in the Snohomish estuary and nearshore marine habitats, which include beach seining and fyke netting, will continue to provide important information on the co-occurrence, out-migration timing, relative abundances, and relative size (fork lengths, whole body weights, and condition factors).

These studies also afford unique opportunities to collect biological samples (such as otoliths, scales, tissues for DNA, stomach contents for predation studies) of listed fish, program fish, and other fish present during the out-migration or during juvenile estuarine and nearshore residency. This will enable Co-managers to continue to assess the extent to which any overlap might occur with juvenile program fish and other fish, including listed juvenile Chinook in freshwater, the

estuary, or in the nearshore environment after program fish are released. All assessments of juvenile and program adult coho interactions will require 100% otolith marking, if and when Hatchery Reform or Hatchery Rehab funding becomes available for this.

SECTION 12. RESEARCH

12.1) Objective or purpose.

Please see the preceding Section 11 for M&E projects that are also research projects. In addition, hatchery coho otolith marking and recovery M&E and research projects are being proposed in order to distinguish juvenile and adult hatchery and natural stock components. This will enable evaluations of stray rates, hatchery and natural escapement estimates, and evaluations of ecological interactions between program coho yearlings and ESA-listed Chinook juveniles. This 100% marking, contingent on funding availability, will complement ongoing juvenile salmonid monitoring and research efforts in the river, estuary, and nearshore marine areas. In addition, both the tribes and State have active coho coded-wire tagging, and adipose fin clipping programs currently in place.

With adequate funding, an adult coho recovery program could be implemented in the Snohomish basin in the same fashion as the ongoing Tulalip adult Chinook otolith and coded-wire tag M&E program (which has been funded under Hatchery Reform) to allow for enumeration of hatchery and natural stock components in the Snohomish coho escapement and for evaluations of straying. Annual accomplishment of research projects listed throughout this HGMP is contingent on availability of funding. As of 2004, most hatchery reform and HGMP monitoring projects have been accomplished primarily through acquiring Hatchery Reform and self-governance funds specifically dedicated for hatchery reform and rehabilitation.

Very little is known about the relative contributions of natural- and hatchery-origin program coho and listed Chinook salmon juveniles and other salmonid juveniles to overall abundances, productivities, habitat capacities and utilization, temporal and spatial distributions of juvenile or adult fish, or spawning escapements in the Snohomish basin.

In addition to learning more about these important aspects of species viability, critical knowledge pertaining to life history diversity, such as behavior and ecological interactions within specific cohort stock components of a species (i.e. between hatchery fish of the same age and release group), as well as within stock components (i.e. between different rearing or release groups of the same program fish), or between stock components (i.e. hatchery vs wild), or between different species, are currently being obtained by these studies. Obtaining funding for 100% otolith marking of program coho will enable identification of individual program fish in the estuary trapping efforts to allow for stomach content analysis and general observations of temporal and spatial co-occurrences with ESA-listed juvenile Chinook salmon to evaluate potential predation impacts and risks.

These studies will provide valuable information to improve hatchery program effectiveness and aid salmon recovery in accordance with region-wide recovery plans and hatchery reform efforts.

Project 1) Juvenile smolt trapping in the Skykomish and Snoqualmie Rivers.
Project 2) Juvenile salmonid utilization of the Snohomish River estuary.
Project 3) Contribution of hatchery- and natural-origin coho salmon to natural and hatchery spawning areas, Tribal terminal area fisheries, and escapement estimation for the Snohomish basin using thermal mass-marking of otoliths (proposed new study).
Project 4) Contribution of hatchery- and natural-origin coho salmon to natural and hatchery spawning areas, ocean and freshwater fisheries, and escapement estimation for the Snohomish basin using coded-wire tagging, fin clipping, and recoveries in fisheries and on spawning grounds (proposed).

12.2) Cooperating and funding agencies.

The Tulalip Tribes (smolt trapping, estuarine and nearshore marine trapping and seining, ecological interactions, adult otolith marking (proposed), adipose fin marking, coded-wire tagging, adult coho recovery programs in the Tribal fishery and throughout the Snohomish basin - proposed), NOAA fisheries (estuarine and nearshore trapping and seining, ecological interactions, and WDFW (smolt trapping, estuarine and nearshore trapping and seining, ecological interactions, adult otolith marking - proposed, adipose fin marking, coded-wire tagging, adult coho recovery programs in the Snohomish basin - proposed).

12.3) Principal investigator or project supervisor and staff.

1) Smolt trapping operations: Kurt Nelson, Brian Kelder, Kit Rawson, Mike Crewson, and technician crew; Tulalip Environmental / Natural Resources Department.

2) Estuarine and nearshore marine environment habitat utilization and species composition studies: Mindy Rowse and Kurt Fresh (NOAA Fisheries), Brian Kelder, Kurt Nelson, Todd Zackey, Mike Crewson, Kit Rawson (Tulalip Environmental / Natural Resources Department).

3) Otolith marking and monitoring the contribution of hatchery- and natural-origin coho salmon to natural and hatchery spawning areas and escapement estimation for the Snohomish basin using thermal mass-marking of otoliths (proposed new study): Mike Crewson, Kit Rawson (Tulalip Natural Resources / Fisheries Department), Robert Skoog, Richard Young, and technician crew (Tulalip Environmental / Natural Resources Department), and Curt Kraemer and Eric Volk (WDFW).

4) Coded-wire tagging, fin marking, and mark/tag recoveries in fisheries and on hatchery and on natural spawning areas (estimate directed and non-landed fishery mortality, conduct and evaluate DIT and preserve integrity of the coded-wire tagging system, evaluate mark-selective fisheries and impacts on ESA-listed salmon stocks and other natural-origin salmonids, measure run timing, survival rates, migration patterns, and stray rates into other watersheds: Kit Rawson, Marla Maxwell, Mike Crewson, and technician crew (Tulalip Natural Resources/Fisheries Department), Curt Kraemer Doug Hatfield, and Darin Combs, and technician crew (WDFW).

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

Same as in Section 2.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

Publications, annual reports, draft summary reports, Biological Assessments and Opinions are available with these details.

12.6) Dates or time period in which research activity occurs.

Previously described and included in the aforementioned reports and assessment documents.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

Previously described and included in the aforementioned reports and assessment documents.

12.8) Expected type and effects of take and potential for injury or mortality.

Previously described and included in the aforementioned reports and assessment documents.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

Previously described and included in the aforementioned reports and assessment documents.

12.10) Alternative methods to achieve project objectives.

Conducting no M&E and research actions was the previous alternative, which was rejected and replaced with the Hatchery Reform monitoring projects described above.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

N/A. Negligible mortality of other juvenile salmonids is thoroughly documented in the smolt trapping and estuarine trapping and seining projects.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

Previously described above or in the aforementioned reports and is specified in the assessment documents.

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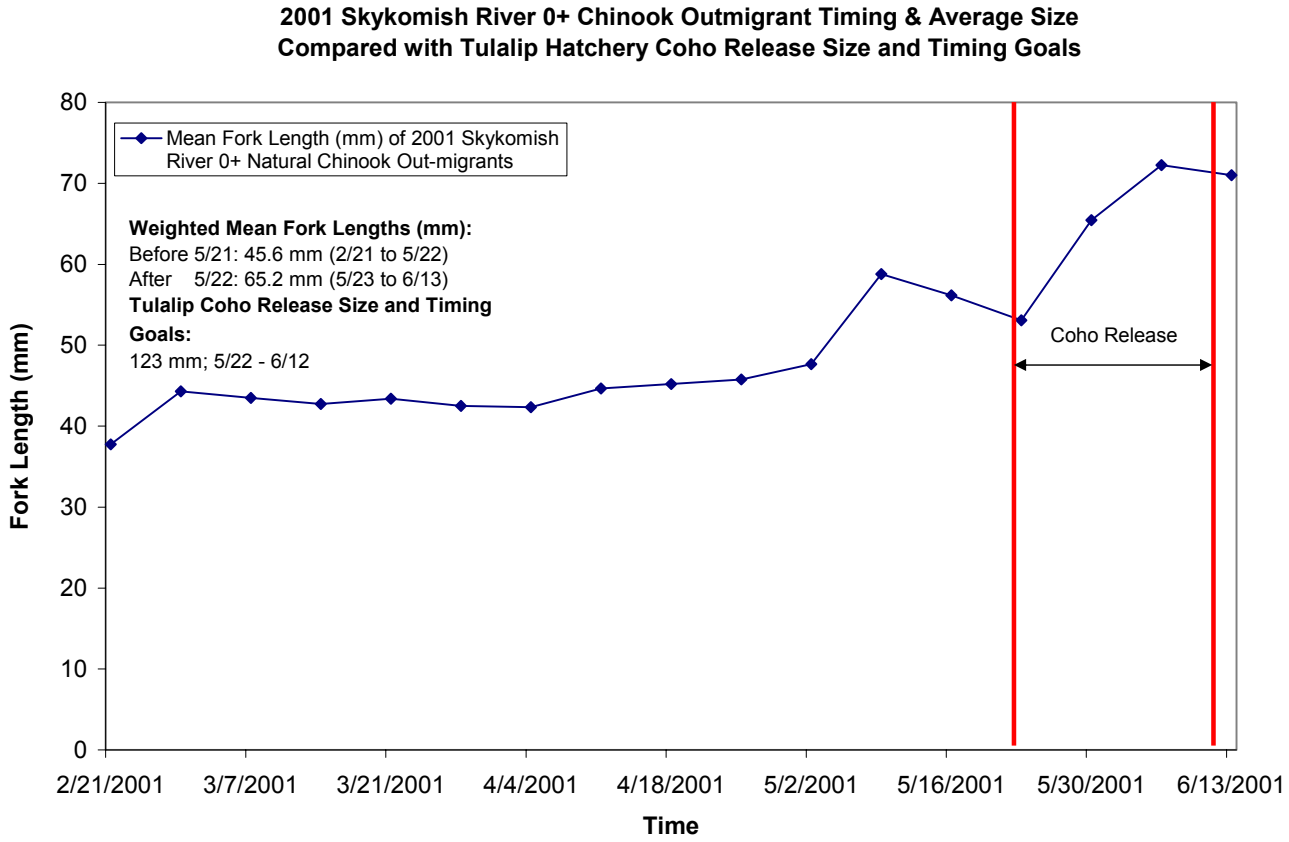
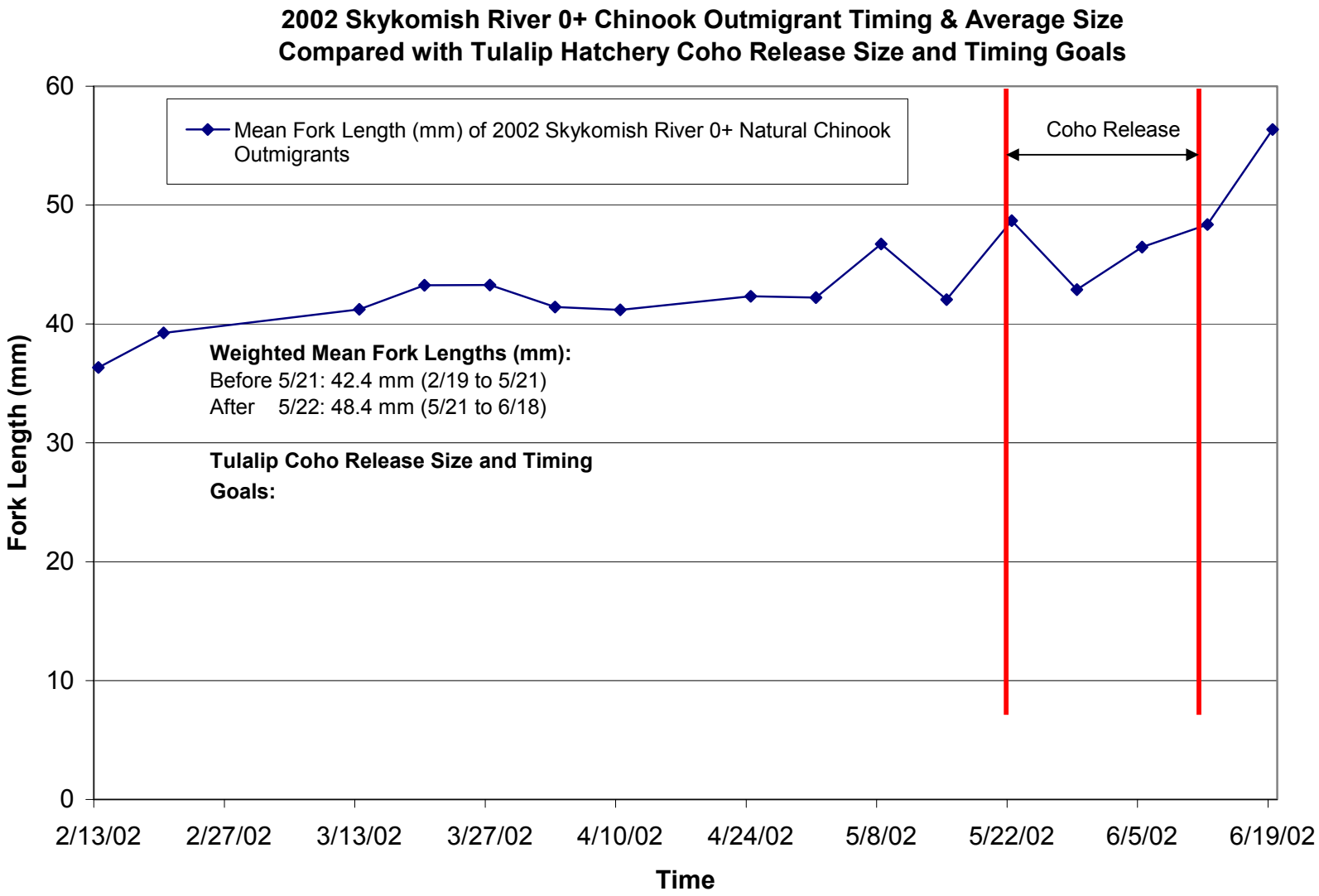
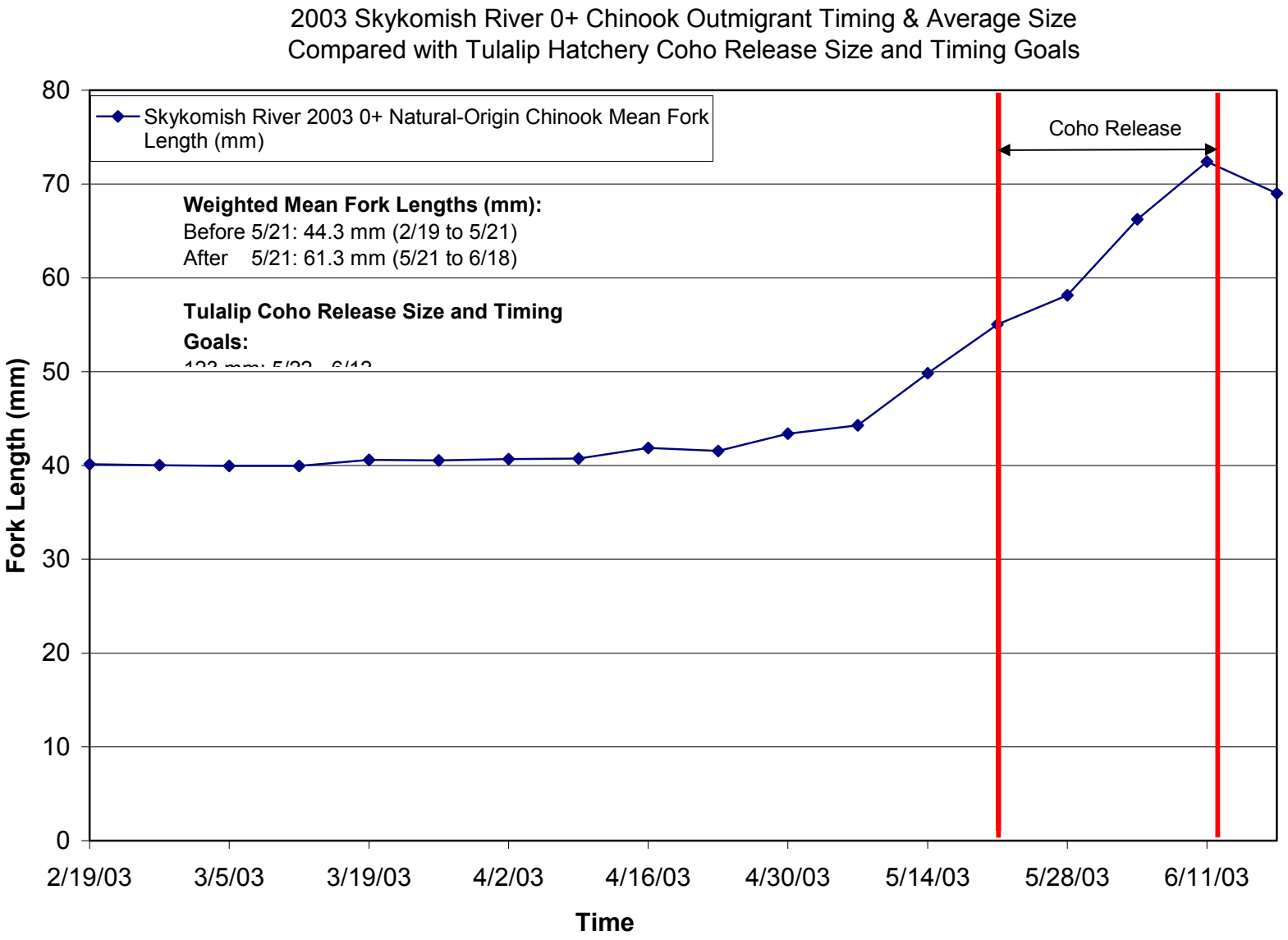
SECTION 13. ATTACHMENTS

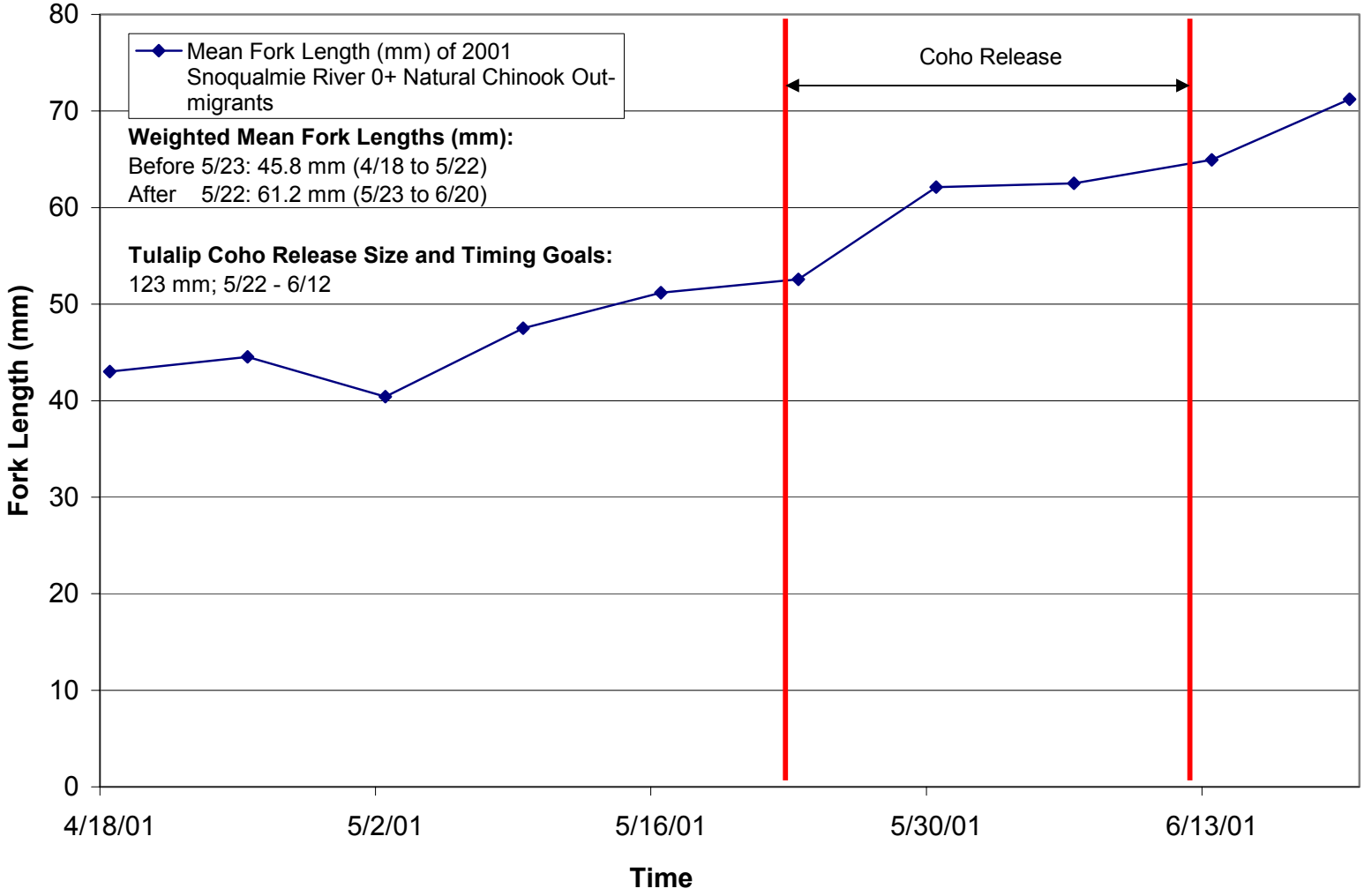
Attachment 1. Out-migrant Chinook fry size and timing graphs for 2001-2003 for Skykomish, Snoqualmie, and Stillaguamish River relative to revised Tulalip coho release size and timing goals, and Tulalip smolt trapping reports for Skykomish (2001-2003) and Snoqualmie (2002-2003) Rivers. Reports and graphs are based on preliminary data and should not be used without permission of the Tulalip Natural Resources Department.

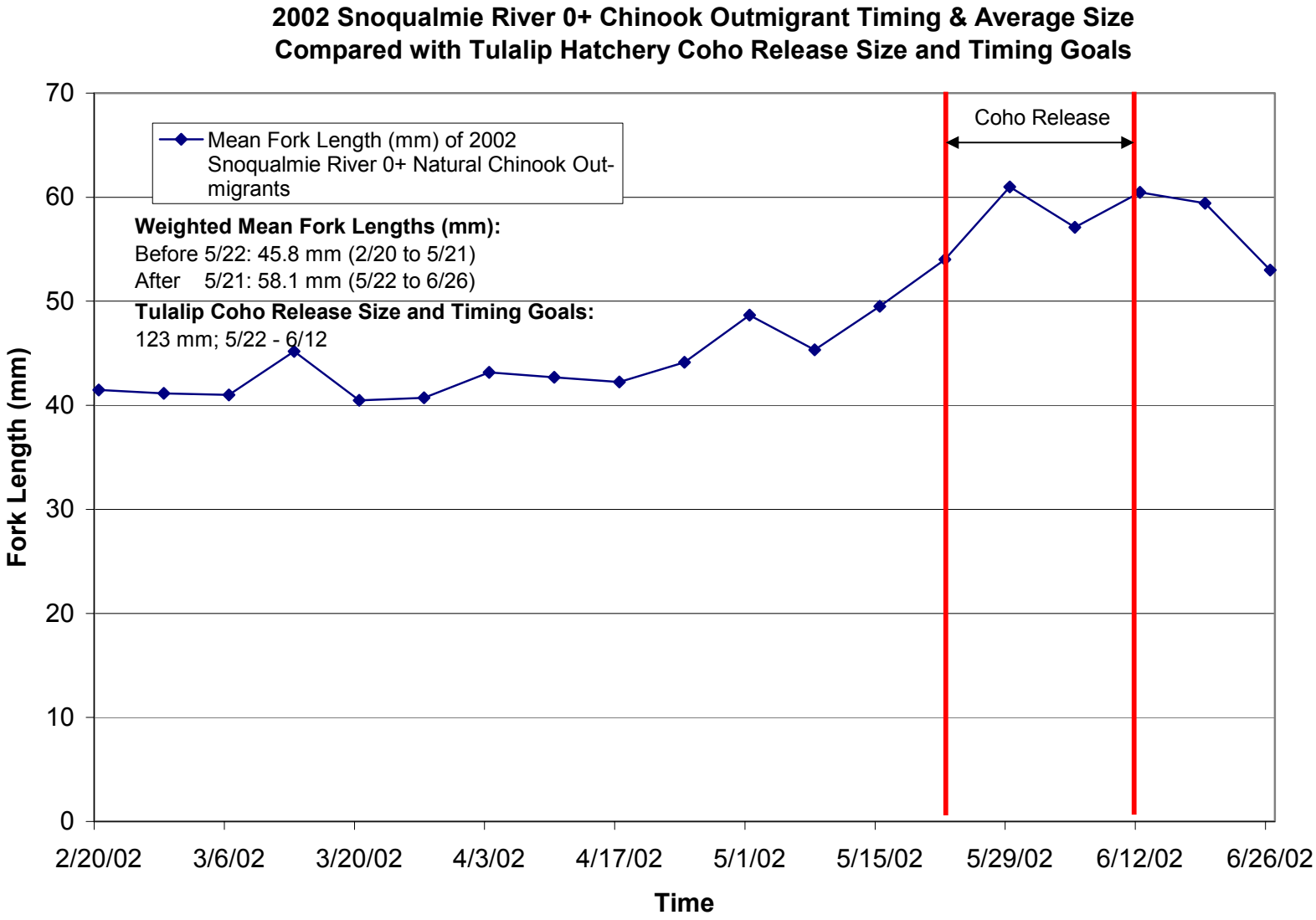



2002 Skykomish River 0+ Chinook Outmigrant Timing & Average Size
Compared with Tulalip Hatchery Coho Release Size and Timing Goals
Mean Fork Length (mm) of 2002 Skykomish River 0+ Natural Chinook Outmigrants
Coho Release
Weighted Mean Fork Lengths (mm):
Before 5/21: 42.4 mm (2/19 to 5/21)
After 5/22: 48.4 mm (5/21 to 6/18)
Tulalip Coho Release Size and Timing Goals:
Fork Length (mm)
60
50
40
30
20
10
0
2/13/02
2/27/02
3/13/02
3/27/02
4/10/02
4/24/02
5/8/02
5/22/02
6/5/02
6/19/02
Time

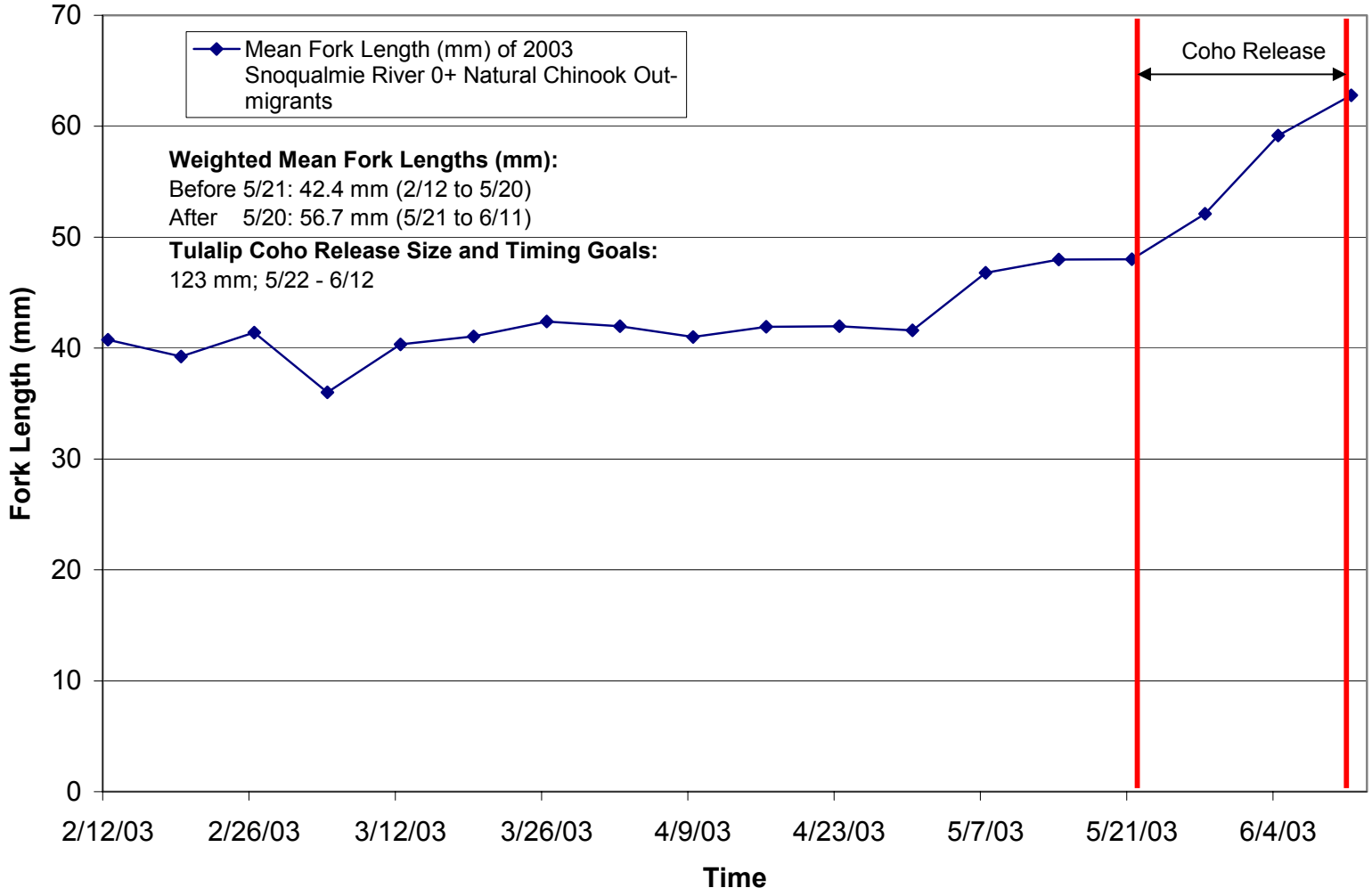

2003 Skykomish River 0+ Chinook Outmigrant Timing & Average Size
Compared with Tulalip Hatchery Coho Release Size and Timing Goals
Skykomish River 2003 0+ Natural-Origin Chinook Mean Fork Length (mm)
Coho Release
Weighted Mean Fork Lengths (mm):
Before 5/21: 44.3 mm (2/19 to 5/21)
After 5/21: 61.3 mm (5/21 to 6/18)
Tulalip Coho Release Size and Timing Goals:
Fork Length (mm)
80
70
60
50
40
30
20
10
0
2/19/03
3/5/03
3/19/03
4/2/03
4/16/03
4/30/03
5/14/03
5/28/03
6/11/03
Time

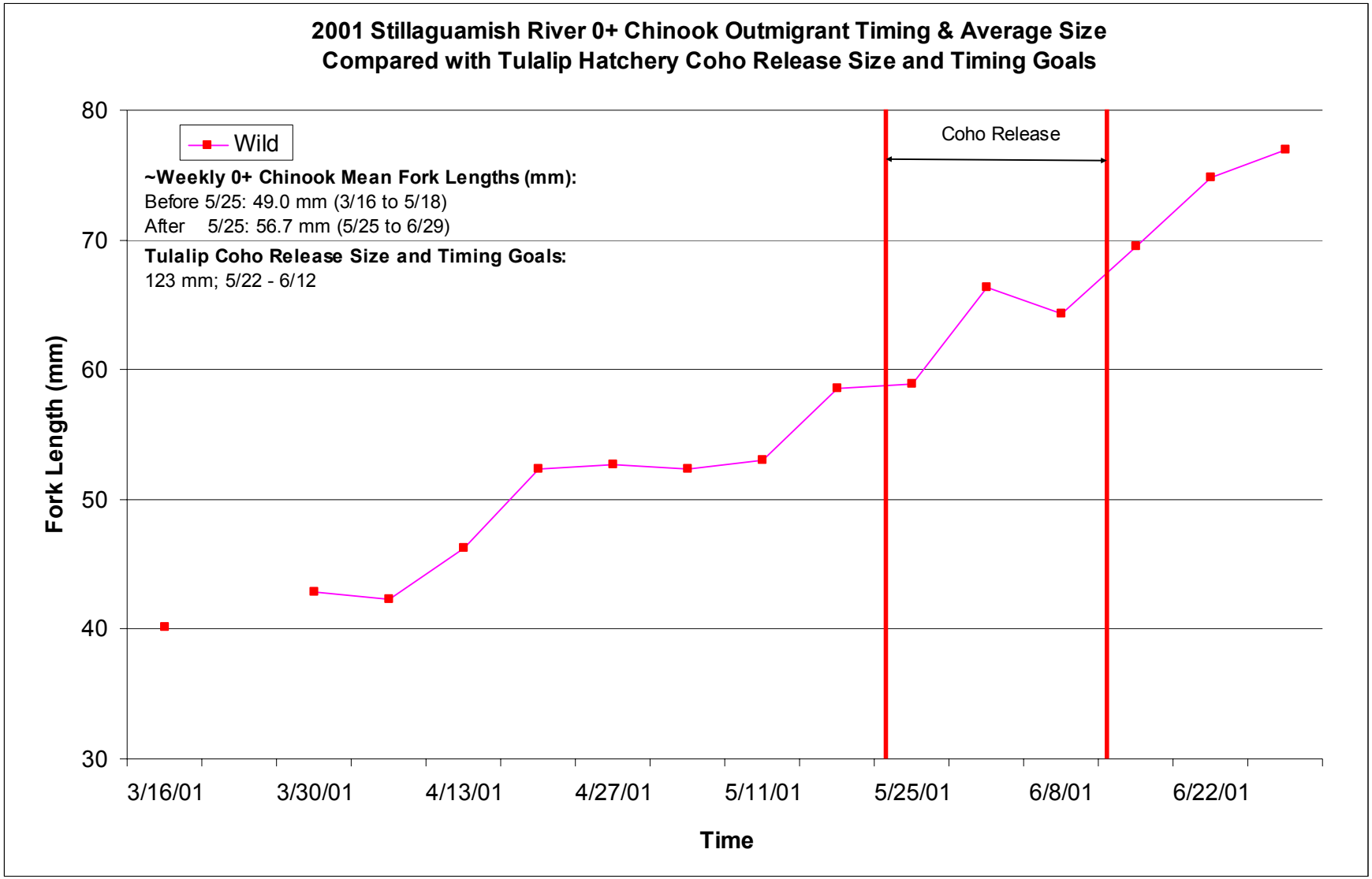
2001 Snoqualmie River 0+ Chinook Outmigrant Timing & Average Size Compared with Tulalip Hatchery Coho Release Size and Timing Goals

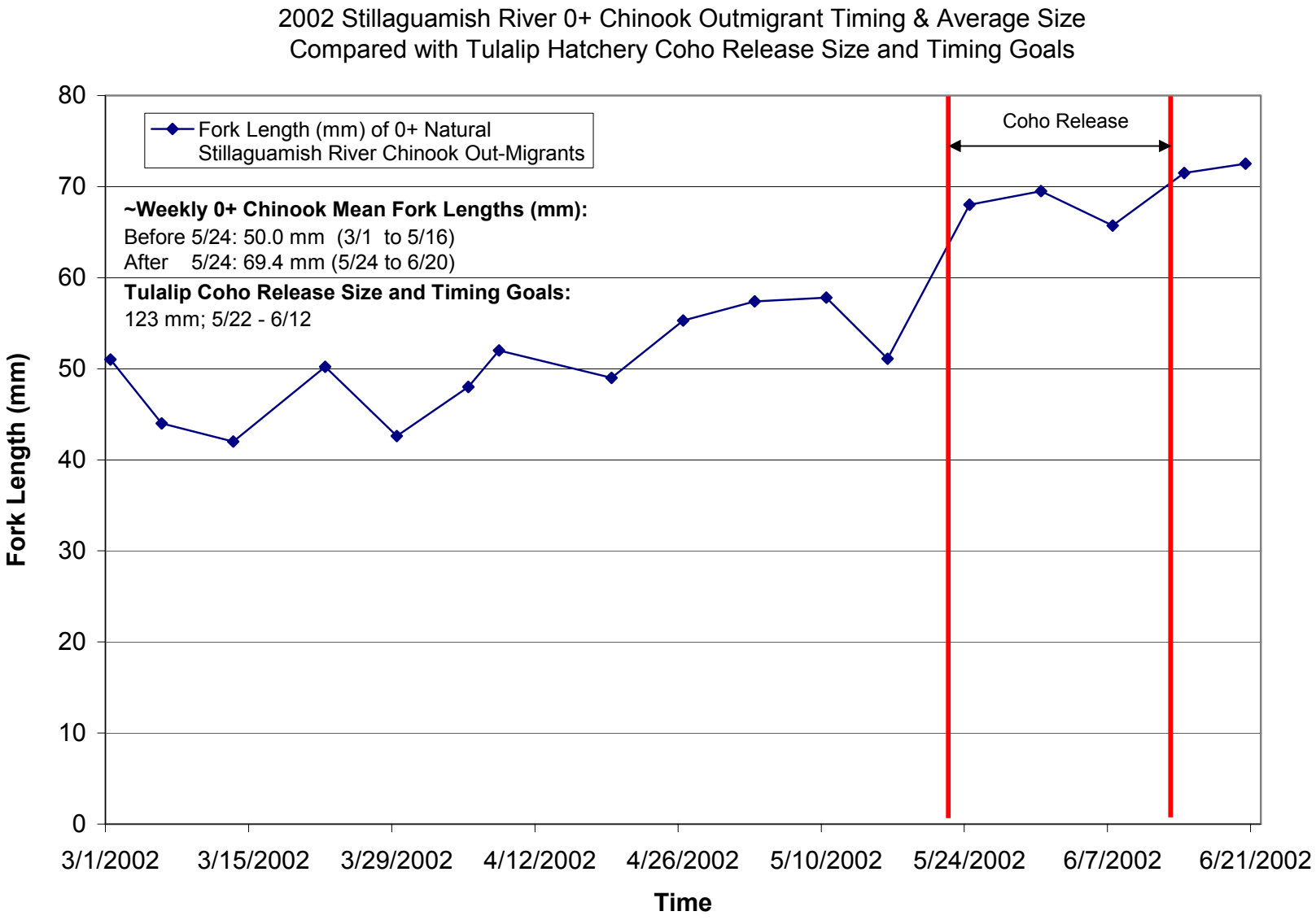



2002 Snoqualmie River 0+ Chinook Outmigrant Timing & Average Size
Compared with Tulalip Hatchery Coho Release Size and Timing Goals
Mean Fork Length (mm) of 2002 Snoqualmie River 0+ Natural Chinook Out-migrants
Weighted Mean Fork Lengths (mm):
Before 5/22: 45.8 mm (2/20 to 5/21)
After 5/21: 58.1 mm (5/22 to 6/26)
Tulalip Coho Release Size and Timing Goals:
123 mm; 5/22 - 6/12
Coho Release
Fork Length (mm)
70
60
50
40
30
20
10
0
2/20/02
3/6/02
3/20/02
4/3/02
4/17/02
5/1/02
5/15/02
5/29/02
6/12/02
6/26/02
Time

2003 Snoqualmie River 0+ Chinook Outmigrant Timing & Average Size Compared with Tulalip Hatchery Coho Release Size and Timing Goals




2001 Stillaguamish River 0+ Chinook Outmigrant Timing & Average Size
Compared with Tulalip Hatchery Coho Release Size and Timing Goals
Wild
~Weekly 0+ Chinook Mean Fork Lengths (mm):
Before 5/25: 49.0 mm (3/16 to 5/18)
After 5/25: 56.7 mm (5/25 to 6/29)
Tulalip Coho Release Size and Timing Goals:
123 mm; 5/22 - 6/12
Coho Release
Fork Length (mm)
80
70
60
50
40
30
3/16/01
3/30/01
4/13/01
4/27/01
5/11/01
5/25/01
6/8/01
6/22/01
Time


2002 Stillaguamish River 0+ Chinook Outmigrant Timing & Average Size
Compared with Tulalip Hatchery Coho Release Size and Timing Goals
Fork Length (mm) of 0+ Natural
Stillaguamish River Chinook Out-Migrants
Coho Release
~Weekly 0+ Chinook Mean Fork Lengths (mm):
Before 5/24: 50.0 mm (3/1 to 5/16)
After 5/24: 69.4 mm (5/24 to 6/20)
Tulalip Coho Release Size and Timing Goals:
123 mm; 5/22 - 6/12
Fork Length (mm)
0
10
20
30
40
50
60
70
80
3/1/2002
3/15/2002
3/29/2002
4/12/2002
4/26/2002
5/10/2002
5/24/2002
6/7/2002
6/21/2002
Time

2003 Stillaguamish River 0+ Chinook Outmigrant Timing & Average Size Compared with Tulalip Hatchery Coho Release Size and Timing Goals